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AGROTECHNOLOGY AND FOOD RESOURCES

No. 12

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OVERVIEW OF BELORUSSIAN AGRICULTURE SINCE 1965 PLENUM OF CC CPSU

Minsk KOMMUNIST BELORUSSII in Russian No 11, Nov 80 pp 57-64

[Article by M. Moroz, deputy head of Agricultural Department of the Central Committee Belorussian Communist Party: "Limits of Creative Research"]

[Text] Agriculture is one of the more complicated and dynamic branches of our economy. The fluctuations in production volumes and in the rates for its development are determined to a considerable degree by the natural-climatic and weather conditions. The seasonal nature of production and the requirement, distinct from industry, for almost constant organization of a great amount of preparatory work, especially in farming, demand additional efforts and the mandatory creation of a considerable reserve of stability in all of its elements.

The centuries-old trend in the soil cultivation process in the nonchernozem zone, which includes Belorussia, has promoted the creation of acid and nutrient-poor land, vast tracts of sandy soil and light-contour sectors of extremely low fertility. In our republic they constitute more than one half of all agricultural lands. The irregular distribution of precipitation by periods of the year and territories, over vast areas, has resulted in the water-logging and swamping of land. In the annual cycle, these fluctuations lead to periodic recurring droughts and water-logging and this in the final analysis results in a considerable shortfall in farming and animal husbandry output. Thus the farmers must counter the caprices of nature with ever-increasing professional expertise, strict observance of the organizational-technological regimes and proper utilization of all material and labor resources.

As a result of the tremendous assistance provided by the state, the republic's kolkhozes and sovkhozes have strengthened considerably their logistical base. During the past 4 years alone, the rural areas have been supplied with 61,400 tractors, 14,500 grain harvesting combines, 39,400 trucks and many other items of equipment. The power-worker ratio has been raised by a factor of 1.3. A great program has been implemented in connection with the reclamation of land and the construction of production, housing and cultural-domestic installations.

Supported by a powerful material base, the kolkhozes and sovkhozes have increased noticeably their production of farming and animal husbandry products. Compared to the Ninth Five-Year Plan, the average annual gross output volume during 4 years of the five-year plan increased by more than 18 percent. Grain production increased by 17, sugar beets -- by 14, potatoes -- by 9, meat -- by 21, milk -- by 4 and eggs --

by 56 percent. The entire increase was achieved by means of improved labor productivity, which was raised by 28 percent. The production plans and the plans for selling sugar beets, potatoes, eggs and wool to the state were all over-fulfilled.

At the same time, the agricultural workers, in critically evaluating the results already achieved, have undertaken even more complicated tasks as a result of the decisions handed down during the July (1978) Plenum of the CC CPSU and the instructions issued by Comrade L.I. Brezhnev upon the occasion of conferring one of the homeland's highest awards upon the hero-city of Minsk. They are doing everything possible to ensure that the increasing amounts of capital being invested in the branch and also the greater quantities of equipment, fertilizers and other resources being supplied to the kolkhozes and sovkhozes are utilized with the greatest effectiveness.

As is well known, the agrarian reforms implemented in our country were based upon a strong foundation of Marxist-Leninist theory and upon a thorough taking into account and utilization of the objective laws of socialism. On the basis of these reforms, our party is successfully implementing large-scale measures associated with the use of chemical processes and land reclamation, the mechanization and automation of production processes and concentration and specialization in all branches of agriculture based upon interenterprise cooperation and agroindustrial integration.

The achievements realized in the development of agricultural production by the country's workers following the March (1965) Plenum of the CC CPSU are the result of the implementation of the party's scientifically sound agrarian policies and the constant strengthening of the link between science and production. In response to the concern being displayed by the party and people for scientific development, the scientists are carrying out their tasks in a purposeful and selfless manner. They are constantly searching for basically new solutions which will revolutionize production and open up a broad expanse for growth in the productive forces and for improvements in production relationships. Moreover, they are aware that only complex, comprehensive and continuous development of science itself and a systematic approach for utilizing its conclusions and results will make it possible, under modern conditions, to realize constant scientific-technical progress and produce a high national economic effect.

It is obvious that successes in the development of the agricultural science cannot be viewed apart from achievements realized in kolkhoz-sovkhoz production. At the same time, progress in this complicated branch of the national economy is unthinkable if use is not made of scientific developments or if support is not sought from modern science. In reviewing the period which the kolkhozes and sovkhozes have passed through since the March (1965) Plenum of the CC CPSU and in analyzing the results achieved and the means and methods by which they were obtained, the republic's agricultural workers render proper credit to the scientists of scientific-research institutes, higher educational institutes and experimental stations, who made valuable contributions towards solving the basic problems associated with the development of agricultural production.

During the past few years, the republic's scientific institutes solved many important tasks in the sphere of farming and animal husbandry, reclamation and economics. These solutions are making it possible for our agricultural workers

to raise the cropping power of all agricultural crops as well as the productivity of the livestock and production efficiency.

Special importance is being attached to the results of studies on raising soil fertility and improving its physical and agrochemical properties. The scientific proposals for the efficient use of mineral and organic fertilizers, for validating the system for liming acid soils and for ensuring their normal air-water, thermal and food regimes, through the carrying out of land reclamation measues, will make it possible for the republic's kolkhozes and sovkhozes to obtain larger quantities of agricultural products annually.

Many new varieties of agricultural crops have been created as a result of the selfless work performed by scientific personnel. The unique tetraploid Belta variety of winter rye, developed by plant breeders at the Belorussian Scientific-Research Institute of Farming, under the direction of Hero of Socialist Labor N.D. Mukhin, is now being grown on more than 1.2 million hectares throughout the country and in our republic -- approximately four fifths of all plantings of this crop. It has been regionalized in many oblasts of the RSFSR, UkSSR, Moldavia and the GDR. The economic effectiveness realized during the Ninth Five-Year Plan from the introduction of this variety alone amounted to more than 103 million rubles.

New varieties have been regionalized this year -- Belorusskaya-23 winter rye and Belorusskaya-12 spring wheat. Barley specimens having a cropping power of up to 80 quintals per hectare have been bred and turned over for state strain testing. The flax varieties Orshanskiy-2, Orshanskiy-72 and Progress have been created and regionalized in the republic by the flax plant breeders. These varieties produce high quality fibre and they display a high resistance against lodging.

The highly productive potato varieties Temp, Ogonek, Belorusskiy Ranniy, Komsomolets, Loshitskiy, Sadko and others are praised highly among the republic's workers, throughout the country and also abroad. They were created at the Belorussian Scientific-Research Institute of Potato Growing and Fruit and Vegetable Production by a group of laureates of the USSR State Prize, headed by Hero of Socialist Labor and Academician of VASKhNIL [All-Union Academy of Agricultural Sciences imeni V.I. Lenin] P.I. Al'smik. At the present time, these potato varieties occupy 92 percent of the potato plantings in the republic and throughout the country -- 31 percent. This year the Prigozhiy-2 and Verba varieties, which possess valuable economic-technological qualities, were regionalized. The institute's workers have created and turned over for state strain testing four new varieties of potatoes and highly productive varieties of cabbage, cherries, apples and European black currants.

The collective at the Belorussian Scientific Research Institute of Animal Husbandry bred new highly productive strains of swine--Belorussian Black-Variegated and a large white strain, which are distinguished by high meat qualities. The economic effect from the breeding of these strains during 1978 amounted to 8 million rubles. Many valuable innovations have been developed by workers at the scientific-research institutes for the mechanization and electrification of agriculture in the nonchernozem zone of the USSR, land reclamation and water management, plant protection, experimental veterinary science, economics and agricultural organization.

Scientists assigned to VUZ's throughout the republic play a great role in the development of the science of agriculture. In recent years, a great deal has been accomplished towards strengthening the theme plans and on concentrating the efforts of the VUZ scientists on carrying out theoretical and applied studies. The institutes of the Academy of Sciences of the BSSR have proposed a number of interesting developments for agricultural production.

More than 10 scientific-research institutes, four higher educational institutes, six oblast and four branch agricultural experimental stations are presently carrying out studies in the sphere of agriculture. The overall number of scientific and scientific-pedagogical workers engaged in agricultural problems amounts to several thousand individuals, including 75 doctors and more than 1,400 candidates of science. Within the Ministry of Agriculture system for the BSSR alone, the number of scientific workers increased twofold during the 1965-1979 period. In addition, three institutes of the Academy of Sciences for the BSSR are participating in the work of developing the problems of the agrarian science: genetics and cytology, experimental botany and peat. The western branch of VASKhNIL serves as the coordination center for the science of agriculture.

At the present time, the scientific institutes have a relatively good base at their disposal for conducting studies and obtaining a production evaluation of the results of their work. They have 99 test-experimental and support farms at their disposal. Successful work is being performed by the Western Breeding Center for Grain, Pulse and Groat Crops of the Institute of Farming, where a 2,500 meter phytotron has been placed in operation. As a result, it has become possible to propagate the initial stock more rapidly and accelerate the breeding process. Breeding centers have also been created for pedigree animal husbandry and also for potato, vegetable and fruit crops. Finally, a conversion has been carried out over to the special purpose programming principle for the planning of scientific studies.

Owing to improvements in the planning, organization and coordination of scientific studies, better results and a higher theoretical level are being realized. With each passing year, more and more scientific studies are being introduced into agricultural production. During the years of the Ninth Five-Year Plan alone, more than 365 works carried out at scientific institutes throughout the republic were employed at kolkhozes and sovkhozes in a practical manner. The economic effect realized from their introduction into operations amounted to 198.2 million rubles. For example, compared to the Eighth Five-Year Plan when only 65 author certificates were issued for inventions associated with the study themes, during the Ninth Five-Year Plan -- 170 and during the past 4 years studies were defended by 212 author's certificates.

The scientific-research institutes are constantly expanding their international contacts. Fruitful collaboration has been organized with GDR scientists on such problems as plant breeding, soil fertility, breeding work, automation of production operations and so forth. As a result of a uniting of efforts by workers at the Belorussian Scientific-Research Institute of Farming and the Institute of Plant Breeding at Gyul'tsev-Gyustrov (GDR), the new Gibrid-67 tetraploid variety of winter rye was created and turned over for state strain testing. Last year, at the Mogilev and Volkovysk strain testing stations, this rye produced 54 quintals of grain per hectare. This new variety is presently being supplied to farms throughout

the republic. At the Mayak Kommunizma Kolkhoz in Borisovskiy Rayon, the Gibrid-67 variety was sown on more than 180 hectares this year. A good yield was obtained. Such barley varieties as El'gina, Trumpf and Nadya, bred in the GDR, are being introduced successfully into operations in Belorussia. The highly productive nematode-resistant Adretta potato variety is being propagated. Close contacts have also been established with scientists in Poland and Bulgaria.

A positive evaluation has been handed down regarding the carrying out of joint studies and the exchanging of opinions between scientists in the western region and in other union republics of the country.

The most burning and vital questions associated with accelerating scientific-technical progress are reflected in the decisions handed down by the Central Committee of the Communist Party of Belorussia and the Council of Ministers for the BSSR. The scientific developments of institutes, for example, found comprehensive materialization in the decree of the Central Committee of the Communist Party of Belorussia and the government of the BSSR entitled "On the Principal Trends in Land Reclamation Construction and the Utilization of Reclaimed Lands Throughout the Republic," which constituted a developed program for the conservation and rational utilization of shallow-bed peat bogs, protection of the biosphere and the intensification of feed production.

For a long period of time the republic's kolkhozes and sovkhozes have not obtained a proper return from their mineral fertilizers. Although the deliveries of fertilizers to the rural areas have been increasing with each passing year, the effectiveness of their use has remained low on a majority of the farms. On the basis of work carried out at the Belorussian Scientific Research Institute of Soil Science and Agricultural Chemistry, measures were prepared aimed at raising the effectiveness of use of organic and mineral fertilizers. Since then, the indicator for the return from mineral fertilizers has been included in the industrial financial plans and is being reflected in the reports of kolkhozes and sovkhozes. The strict fulfillment of the measures planned, strict control and the requirement that the personnel ensure rational use of the fertilizers have produced perceptible results. The return from the use of the fertilizers is increasing with each passing year.

Agriculture is presently in need of a constant flow of new ideas that will accelerate scientific-technical progress, promote rapid growth in production and raise its efficiency. However, a number of vitally important problems associated with the agrarian science are still being solved only slowly. Individual varieties of Belorussian selection do not possess an adequately high plasticity. The absence, for example, of frost-hardy and disease-resistant varieties of winter crops, considering the conditions found in the republic, is one of the reasons why the plantings of these crops must be resown over large areas each year. As yet, thorough studies are still not being carried out on the resistance of grain and other crops to lodging. Proper attention is not being given to the problems concerned with reducing the consumption norms for seed and planting stock, improving the production technology for agricultural products, raising the genetic potential of the animals and the productivity of the livestock and reducing the amounts of labor and resources required for the production of a unit of output.

In the work being carried out by our economists, proper attention is not being given to the development of studies on production specialization and concentration,

interenterprise cooperation, improving the organizational forms for control and on theoretical and practical matters associated with the social development of the modern rural areas and with stabilization of the labor resources, problems which are confronting many rayons throughout the republic.

There are still many unresolved problems in the area of feed production. The work of creating mechanization equipment for the procurement of hay and haylage, organizing the servicing of the machine-tractor pool and ensuring the highly efficient use of equipment is still not being carried out at the proper level. New methods for diagnostics and for preventing infectious diseases in animals are being developed very slowly.

These and other shortcomings in research work are seriously restraining an acceleration in scientific-technical progress and affecting the rates for the intensification of agricultural production. The party organizations and the scientific councils of scientific research institutes and experimental stations must carry out a great amount of work in order to ensure the realization of the decree of the CC CPSU and the USSR Council of Ministers entitled "Measures for Further Raising the Effectiveness of the Agricultural Science and Strengthening Its Links With Production," and also the 19th Plenum of the Central Committee of the Communist Party of Belorussia on matters concerned with accelerating scientific-technical progress. A principal concern at the present time is that of ensuring that the efforts of the scientific collectives are concentrated on solving the key problems concerned with the development of agricultural production.

Modern agricultural practice is presenting new and greater requirements with regard to the varieties and hybrids being created; they must combine high productivity with good quality output and possess a complex of valuable biological and economic characteristics and properties. The solving of the grain problem will in the near future confront the plant breeders with a complicated and responsible task: creating new varieties of winter rye having a cropping power of 60-65 quintals per hectare and resistant to snow mold, barley -- 70-80 quintals per hectare and having a high content of protein and lysine. In the case of potatoes, the scientists also have high goals: to breed varieties having a cropping power of up to 1,000 quintals per hectare, possessing fine food and technological indicators and resistant to virus diseases and inclement weather. The scientist livestock breeders must create new lines of cows producing milk yields per cow on the order of 5,000-6,000 kilograms, with a fat content of 3.8-4.0 percent. Sound proposals must be made for specialization and concentration in agricultural production, implemented on the basis of interenterprise cooperation and agroindustrial integration.

The intensification of agricultural production persistently advances the need for stimulating studies on the problem of feed production. Studies on the problems of resistance and stability in farming warrant special attention. The efforts of biologists, physiologists, soil scientists, land reclamation specialists, farmers and machine operators must be directed towards solving these problems.

The scientific studies must be based upon the principle of special-purpose programmed planning and the development of long-term programs for coordinating the efforts of many scientific subunits and collectives. When selecting the trends for scientific development during the Eleventh Five-Year Plan, fixed attention must be

focused on the setting up of complicated multi-factor experiments. Strong solutions must be found for the problems concerned with coordinating the efforts of the scientific-research institutes of Minsel'khoz [Ministry of Agriculture] for the BSSR and the agricultural VUZ's and institutes of the Academy of Sciences of the BSSR, in studying the more important problems of agriculture. This will force the scientific institutes into making more active use of the latest achievements of the basic sciences, improving their own structure and eliminating so-called "obstructions" within the scientific subunits and it will make it possible to maneuver the scientific forces and to propose comprehensive and sound recommendations for production.

Minsel'khoz for the BSSR and the Western Branch of VASKhNIL should define more precisely the operational trends for a number of scientific-research institutes and experimental stations, define their principal tasks and concentrate the forces and resources on solving the more important problems of agricultural production.

At the present time, one of the principal conditions for accelerating scientific-technical progress is that of strengthening the link between science and production. A great deal has already been accomplished in this regard in recent years. The studies are becoming more closely tied in with the production requirements. Individual scientists and entire collectives of institutes, VUZ's and experimental stations are establishing contacts directly with the kolkhozes and sovkhozes. They have their own support points there and they carry out experimental work. The Belorussian Scientific-Research Institute of Animal Husbandry, for example, conducts studies and carries out practical work of a technological nature at more than 60 farms, the Central Scientific-Research Institute of Mechanization and Electrification of Agriculture in the Nonchernozem Zone of the USSR -- on mechanization and automation matters -- at 80 kolkhozes, sovkhozes and large complexes throughout the republic. On the whole, the scientific-research institutes maintain contacts with more than 220 farms. This makes it possible to find more acceptable solutions for the vital problems of agricultural production and to propose scientifically sound recommendations for operational practice, and on the other hand -- permanent contacts with production serve to enrich science itself. Special importance is also attached to strengthening the feedback between production and science. Fine experience has been accumulated in this regard in many rayons in Grodnenskaya, Minskaya and Mogilevskaya Oblasts. The new forms for contacts between the agricultural science and production are promoting considerable improvements in effectiveness and an acceleration in the introduction of scientific works. Here we have in mind the scientific-production associations, where all links in a continuous chain -- "science-production" -- operate according to a single plan.

Of the other forms of contacts between science and production, mention should be made of visits by agricultural specialists from scientific-research institutes and experimental stations for the purpose of studying the latest achievements in science and leading experience. Extensive use is being made of experimental work carried out at the kolkhozes and sovkhozes, of scientific-practical conferences and of thematic seminars on vital problems concerned with agricultural production.

Naturally, there are many problems involved in organizing this work, problems which are awaiting solutions. Agriculture still lacks many modern machines and facilities and it is experiencing a shortage of fertilizers, plant protective agents and so

forth. These are factors of an objective nature. However, for the practical solving of the problem, more attention is being given to the subjective factors. Mention should be made first of all of the shortcomings in the organization of production and in implementing control over the introduction of new and leading developments and in stimulating the material interest of workers. The agricultural organs and the kolkhoz and sovkhoz leaders and specialists must serve as the direct organizers of all of this work. It is their direct responsibility to tirelessly monitor the scientific innovations, ensure that they are made available to production on a rapid basis and disseminate on an extensive scale the operational experience of those farms where scientific achievements and leading practice are being introduced into operations with great effect. Unfortunately, this is not being done in all areas. Unfortunately, last year many farms failed to fulfill their tasks for introducing new developments into production operations as a result of insufficient attention being given to the introduction of new and leading innovations into production, weak assistance being furnished to the kolkhoz and sovkhoz specialists and an absence of control on the part of the agricultural administrations of oblast and rayon executive committees.

As emphasized during the 19th Plenum of the Central Committee of the Communist Party of Belorussia, a decisive campaign must be waged against stagnation occurring in the practical utilization of scientific developments. If this is not done, further stagnation and a falling behind will be inevitable. Guided by this fact, the majority of the primary party organizations of scientific-research institutes are focusing fixed attention on the problems associated with raising the operational efficiency of their collectives. A great deal is being accomplished in the interest of eliminating subjectivism in the work of the institutes and also the imposing upon production operations of premature and unchecked conclusions and recommendations. In this regard, the operational experience of the Belorussian Scientific-Research Institute of Animal Husbandry has been very instructive. The principal attention of the communists at the institute is being concentrated on further improving the planning and organization of scientific studies, raising the scientific-methodological level of developments and reducing the periods for their implementation, achieving complete solutions for themes, improving the coordination of studies and introducing scientific achievements into production operations. An important aspect of the work carried out in the party organization is that of creating a business-like and creative atmosphere in the collective, strengthening production and labor discipline and increasing the activity and responsibility of workers for their assigned tasks. Serious attention is being given to the proper placement of the communists in connection with the scientific studies, to combining the experience of older scientists with the work being performed by scientific youth, to promoting young and talented scientists to leading positions and to attracting them to participate in scientific-organizational and social activities. A socialist competition among the scientific subunits has been launched on an extensive scale within the institute's collective. Each scientific worker has his own personal plan-obligation.

In our time, the agricultural science, similar to any other science, will become more and more a direct productive force. An acceleration in the rates for scientific-technical progress and the successful fulfillment of the decisions handed down by the party and government for the further development of agricultural production will be dependent upon how well this force serves society and the weight of the contribution it makes. And the tasks assigned to the agricultural workers

are indeed great and important. During the Eleventh Five-Year Plan, the cropping power for grain crops must be raised considerably in the republic, the production of meat and milk must be increased and greater quantities of farming and animal husbandry products must be procured.

In the successful realization of these tasks, an exceptionally great role must be played by science. The creative endeavors of agricultural scientists, based upon a powerful material and technical base and upon constant concern being displayed by the party and government for scientific development, are creating a reliable foundation for achieving new goals in the development of all branches of agriculture.

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DECISIONS OF THE TWENTY-SIXTH CPSU CONGRESS CARRIED OUT: TOWARD NEW ACHIEVEMENTS ON THE ROAD TO COMMUNISM

Moscow SEL'SKOKHOZYAYSTVENNAYA BIOLOGIYA in Russian No 2, Mar-Apr 81 pp 163-166

[Editorial]

[Text] An event of enormous historical importance has occurred in the creative activity of our party and the entire Soviet people--the 26th Congress of the Communist Party of the Soviet Union. Having creatively summarized the practice of building communism in the USSR, with consideration of the experience of other socialist nations, this congress clearly defined the strategy and tactics of our advancement over the next 10 years.

In his report, comrade L. I. Brezhnev, general secretary of the CC CPSU, made a comprehensive analysis of implementation of the decisions of the 24th and 25th congresses of our party; he disclosed in-depth and systematically the unused resources; he showed the main factors that have a retarding effect on advancement of our country toward communism; he defined the general directions of economic and social development of our nation, with due consideration of specific conditions and trends of the 1980's.

This congress approved "The Main Directions of Economic and Social Development of the USSR in 1981-1985 and over the Period up to 1990." This document, prepared by the party, has enormous theoretical and practical importance. It contains further definition and deepening of the conception of developed socialism, specifies the means of further construction of the material and technical base of communism and improvement of welfare of the Soviet people, and opened up new horizons for the building of communism. Some lofty new frontiers have been outlined for our continued advancement. These are difficult, but very realistic frontiers.

In the years of prior five-year plans, the Soviet people achieved high levels of progress in building a new society; an enormous economic and scientific-technological potential has been created. Suffice it to state that the Soviet Union produces one-fifth of the world's industrial product; it is in first place in the world in the areas of producing oil, steel, cement, mineral fertilizers, mainline diesel engines and electric locomotives, as well as wheat and cotton.

A new major step was taken under the 10th Five-Year Plan in development of the national economy and solution of social problems. In the last 5 years (1976-1980),

the national income increased by 400 billion rubles. Industrial production increased by 717 billion rubles and agricultural production by 50 billion. In spite of the fact that 3 years (1977, 1979 and 1980) out of the last 5 were inclement for agriculture because of weather conditions, the mean annual grain harvest reached 205 million tons. There was an increase in production of cotton, livestock and other products. Because of the further strengthening of the material and technical base with modern equipment, agriculture is acquiring an increasingly industrial image.

Refinement of management and scientific-technological progress made it possible to increase productivity of national labor by 17%. Real income per capita increased by 17%. Retail goods turnover increased by 24% and domestic services by 43%. Housing conditions have been improved for more than 50 million people; progress has been made in the areas of education, culture, public health, physical culture and sports.

In the 1980's, the Communist Party will continue to systematically implement its economic strategy, the highest objective of which is to consistently raise the people's material and cultural standard of living, create optimum conditions for comprehensive [well-rounded] development of the personality, on the basis of continued improvement of effectiveness of national production, increase in labor productivity and growth of social and labor activity of the Soviet people.

The 11th Five-Year Plan will be an important phase in reaching this supreme goal. The main objective of the 11th Five-Year Plan is to assure continued improvement of the welfare of the Soviet people on the basis of persistent and progressive development of the national economy, acceleration of scientific and technological progress, and moving the economy to the route of intensive development, better use of the production potential of our country, utmost economy of all forms of resources and improvement of work quality. In the future, it is also imperative to refine the structure and persistently increase the effectiveness of national production; to improve the quality of production in all sectors of the national economy on the basis of comprehensive intensification thereof; to intensify environmental protection, assure the wise use and reproduction of natural resources; to refine management and standards thereof in all elements of the economy, intensify orientation toward achieving the best end results in the national economy; to increase the effectiveness of foreign economic ties.

In 1981-1985, it is planned to increase the national income used for consumption and saving by 18-20%. Of this increase, at least 85-90% will be achieved by augmenting the productivity of national labor. In the current 5-year period, it is planned to increase production of consumer goods by 27-29% and production equipment by 26-28%. Real income per capita will increase by 16-18%; the income of kolkhoz workers from the public kolkhoz sector will increase by 20-22%.

The congress devoted much attention to development of the agroindustrial complex, which is called upon to reliably provide the nation with food and agricultural raw material. To successfully implement the food program, there are provisions for unified planning, proportionate and balanced development of sectors of the agroindustrial complex, significant strengthening of its material and technical base, improvement of economic ties between sectors, organization of well-defined interaction between them to build up agricultural production, improve its quality, transportation, processing and delivery to the consumer.

The main directions of economic and social development of the USSR include an increase in mean annual agricultural production by 12-14% and labor productivity in the public sector by 22-24% over the 5-year period.

Acceleration of transfer of agriculture to an industrial footing and use of progressive technology, to achieve dynamic development and greater effectiveness of all sectors is the first and foremost objective in the field of agriculture.

In farming, the most important objective is to increase soil fertility and yield, continue to increase production of grain, feed and other products on the basis of using zonal, scientifically validated systems of farm management.

It was decided to bring the mean annual grain yield to 238-243 million tons, including 14-15 million tons of leguminous crops, and to increase production and purchase of groats and feed grain.

It is imperative to radically improve feed production, meet the feed needs of the livestock industry in the public sector and for livestock privately owned by citizens, to improve the quality of all types of feed, increase the yield of feed crops and productivity of natural feed plants, as well as to drastically reduce the loss of nutrient value of feed in the process of harvesting and storage. The task has been formulated of completing development and commencing to implement the complex program for creating a reliable and balanced feed base for the livestock industry in our country, to concentrate efforts on solving the problem of feed protein, primarily by increasing planting and considerably increasing production of peas, alfalfa, clover, lupine, soybeans, rape and other crops with high protein content.

Annual production of raw cotton must be brought up to 9.2-9.3 million tons; the quality of the fiber must be improved, there must be expansion of raising cotton of the most valuable thin and medium fiber varieties. Annual mean production of sugar beets must be raised to 100-103 million tons, and there must be an increase in sugar yield from every hectare of planted sugar beets.

We shall also have to increase the productivity and improve the quality of sunflowers, bast-fiber crops (flax, castor plant), essential-oil and other commercial crops, as well as medicinal plants.

We must achieve continued increase in production of potatoes, vegetables and fruit, berries, grapes, tea and subtropical crops in the needed assortment and of high quality.

The following are tasks of paramount importance: refinement of the system of seed growing and converting it to an industrial footing; faster introduction of new, highly productive varieties and hybrids, as well as significant reduction of harvest loss due to pests, diseases and weeds, with considerable expansion of the use of biological means of protecting plants. It is planned to introduce on a wide scale industrial technology for raising corn, sugar beets, sunflowers, soybeans and other crops.

Under the 11th Five-Year Plan, there will be further increase in livestock production, productivity of cattle and fowl: it is planned to bring meat production to an annual mean of 17-17.5 million tons (dressed weight), milk to 97-99 million tons and eggs to at least 72 billion units. To fulfill these tasks, it is

imperative to make broader use of the possibility of increasing beef production by means of intensive raising and fattening of young cattle, take the steps for expanding beef cattle and poultry farming, intensively develop pig raising, achieve increased milk productivity of cows and improve the quality of milk. It is imperative to pay greater attention to development of deer, horse, rabbit and fur farming, pond fisheries, bee keeping and silkworm breeding.

The task has been formulated of increasing significantly the output per head of cattle, of decisively improving herd reproduction and preservation of animals, raising the sophistication of breeding work to upgrade pedigree and productive qualities of animals, creating new, highly productive breeds, strains and hybrids of cattle and poultry to meet the requirements of industrial technology.

With reference to the question of developing agricultural production, comrade L. I. Brezhnev observed: "If we refer to agriculture as a whole, it is faced with the same chief problem as other sectors of the national economy--to increase effectiveness and quality. In the future we shall continue to allocate considerable financial and material resources to rural areas and to convert this sector, on a planned basis, to an industrial footing. But at the present time, the focus is moved to the return from capital investments, growth of productivity of agriculture, deeper and better ties with all sectors of the agroindustrial complex, and this is the distinctive feature of agrarian policy in the 1980's."

In store for agricultural agencies, administrators and farm specialists, scientists and all agricultural workers is the major job of mobilizing, as fully as possible, available internal resources: significantly increase the effectiveness of land use, particularly newly improved areas, use of productive funds, material, financial and manpower resources, to persistently adopt progressive knowhow, upgrade organization of labor and production at kolkhozes and sovkhozes; to implement a system of measures to strengthen cost accounting, lower expenses, increase the profitability of agricultural production and improve the financial and economic state of farms.

Under fully developed socialism, the role of science grows immeasurably as the revolutionizing element of all social development; scientific and technological progress emerges as the main source for improving the effectiveness and intensifying national production.

In the "Main Directions of Economic and Social Development of the USSR in 1981-1985 and up to 1990," approved by the congress, there is a special section on problems of development of science and acceleration of scientific and technological progress. The congress determined that development of science and technology should, under the 11th Five-Year Plan, be governed even more by the need to solve the most important problems of continued progress of Soviet society.

In the area of biological sciences, scientists should concentrate on exploring the mechanism of physiological, biochemical, genetic and immunological processes of vital function, improvement of methods of preventing, diagnosing and treating the most widespread diseases, development of new drugs, agents and medical equipment; breeding highly productive cultivars, animal breeds and cultures of useful microorganisms, new physiologically active substances, including pesticides; development of biotechnological processes to manufacture products used in medicine, agriculture and industry; improvement of efficacy of measures in the

area of environmental protection, wise use of resources of the biosphere, oceans and marine shelves, refinement of methods for forecasting weather and other natural phenomena.

Basing themselves on the advances in theoretical biology, scientists must concentrate on development of pressing problems of increasing the productivity of plants and animals, assuring utmost acceleration of pressing scientific and technological projects related, first of all, to implementation of the food program, since the program for development of agriculture worked out by the 26th CPSU Congress is also a program for the major directions of work in agricultural science.

Biologists are faced with major tasks dealing with development of basically new breeding methods, which are needed to accelerate and improve the effectiveness of the breeding process, to obtain highly productive forms of plants and animals with specified properties and traits consistent with the conditions of intensive farm management. There is the problem of feed protein to be solved, to improve its quality and yield per unit cultivated area; to create better systems of seed growing conforming with the biological distinctions of different agricultural crops; there must be intensification of research pursued to improve the quality of agricultural products and preservation thereof. It is also imperative to practice wiser use and increase the efficacy of means of protection of plants and mineral fertilizers, with mandatory consideration of environmental protection; productivity of newly developed land must be increased in all areas; there must be expansion of the area of application of physiologically active substances to regulate the growth and development of plants and animals, and to increase their productivity; a system of complex measures should be developed to provide for a significant increase in product yield per head with higher coefficients of feed use per unit product; there must be intensification of work on eradication of brucellosis, leukemia and other dangerous diseases, and well-being of livestock from the veterinary point of view must be provided.

A task of major national importance is to deploy, on an even broader scale, scientific work on problems of development of agriculture in areas of intensive development of territorial industrial complexes in Siberia and the Far East, as well as the Nonchernozem zone in the European part of our country. This is a far from complete list of problems that demand the special attention of scientists-biologists in accordance with the program for development of agriculture under the 11th Five-Year Plan and after it.

Maximum results can be achieved in science and particularly in agricultural science only if complex studies are conducted by scientists referable to different specialties. For example, biologists must become very actively involved in problems of mechanization of cultivation of such labor-consuming crops as vegetables, fruit, berries, grapes, cotton, tobacco, as well as complex mechanization of processes in the livestock industry, since we cannot avoid "reconstruction" (sometimes radical) of plants and animals. On the other hand, breeders, physiologists, geneticists, immunologists, agrochemists, phytopathologists and entomologists, veterinarians, agronomers and zootechnicians cannot do without the help of mechanization specialists, land developers [reclamation specialists], economists, power engineers, planners and designers in performing tasks dealing with increase in grain production, solving the feed problem, adopting progressive technologies, increase in animal productivity and solving a number of other problems.

In the proceedings of the congress, much importance was attributed to accelerated introduction into industry of the advances of science and strengthening of the latter's ties with industry. Experience shows that scientific production associations, the number of which has reached 30 in agriculture, is the best form of solution for this problem. The establishment of bases of scientific institutions at kolkhozes and sovkhozes, agreements on creative collaboration of scientists and industrial workers, their joint work to find scientifically substantiated solutions to major industrial problems are also instrumental in bringing science closer to the needs of industry. All of these forms of work must be developed and refined.

Successful implementation of the current five-year plan will assure continued build-up of the nation's economic potential and improved welfare of the people, as well as maintenance at the proper level of the defense capability of the Soviet State; it will increase even more its international authority and will be instrumental in solidifying the world system of socialism and unite all forces fighting for peace and social progress.

The Soviet people are entering into the next decade (1981-1990) full of determination to make it a decade of new great deeds and achievements. There is no doubt that the workers in agricultural science will devote all their knowledge and energy to the struggle for implementing the decisions of the 26th Congress of the Communist Party of the Soviet Union.

10,657
CSO: 1840/525

PRESSING PROBLEMS IN DEVELOPMENT OF PHOSPHATE FERTILIZER INDUSTRY

Moscow KHIMIYA V SEL'SKOM KHOZYAYSTVE in Russian No 8, Aug 80 pp 3-5

[Article by USSR Deputy Minister of Chemical Industry A. A. Novikov]

[Text] Use of mineral fertilizer is one of the principal means for intensifying agricultural production and raising its effectiveness, as was emphasized at the March (1965) CPSU Central Committee Plenum and in subsequent party decisions. It is commonly recognized today that about half of the increment in the agricultural yield is being achieved owing to the use of fertilizer. In this connection domestic industry is increasing its production at an accelerated rate.

The dynamics of mineral fertilizer production in the country in the Eighth, Ninth, and 10th five-year plans offer evidence of successful implementation of the course of all-out chemicalization of agriculture, charted by the March (1965) CPSU Central Committee Plenum. Thus mineral fertilizer production was 3.7 times greater in 1980 than in 1965, which made the USSR the world leader in the production of this product of chemical industry, so important to the national economy.

Growth in fertilizer production made it possible not only to fully satisfy the demand of industrial crops, vegetables, and potatoes, but also significantly expand application of mineral fertilizer to cereal and feed crops, which promoted an increase in their yield. Thus the average yield of cereal crops in the Ninth Five-Year Plan was 14.7 centners per hectare, while in 3 years of the current five-year plan it has been 17.0 centners per hectare.

In addition to increasing production of mineral fertilizers, the Ministry of Chemical Industry is devoting considerable attention to improving the assortment and quality of the products. Transportation, storage, and soil applications of enormous masses of mineral fertilizers require significant material and labor outlays. One important means for economizing on labor and assets is to raise the concentration of nutrients in fertilizer, which would mean preferential growth of the production of concentrated fertilizers with simple action, and complex fertilizers. While at the end of the Ninth Five-Year Plan the proportion of concentrated mineral fertilizers increased to 80.6 percent of the total fertilizer production volume, the figure for 1980 is about 88-89 percent. The average concentration of nutrients in the fertilizers being produced is growing correspondingly as well. During the Ninth Five-Year Plan it increased from 29.6 percent to 36.6 percent, and it will reach 40 percent in the 10th Five-Year Plan.

As we know, our country's soil is poor in phosphorus; this is why the Ministry of Chemical Industry is turning special attention to hastening the increase in output capacities of phosphate fertilizer industry, and to improving the assortment of phosphorus-containing fertilizers. Presently the USSR is producing a broad assortment of phosphorus-containing fertilizers and successfully solving the problem of improving their physicomechanical properties.

Further solution of the problem of supplying phosphorus fertilizers to agriculture will depend primarily on expansion of the country's phosphate resources and development of new forms of phosphate resources significantly inferior in quality to Khibinsk apatite concentrate. This encouraged institutes of the Ministry of Chemical Industry to conduct research aimed at obtaining effective fertilizers for agriculture from various forms of phosphate resources, mainly low-grade.

Production of wet-process phosphoric acid and a highly concentrated, highly effective fertilizer--ammophos--out of Karatau low-grade phosphate stock containing 24.5 percent P_2O_5, 3.5 percent MgO, 2.7 percent R_2O_3, and 5.5 percent CO_2 was successfully developed in the 10th Five-Year Plan. This ammophos possesses excellent physicomechanical properties, and it is suited to both transport and to application both on its own and as an ingredient of dry mineral fertilizer mixtures.

Defluorinated feed phosphate production operations were converted to the processing of Kovdor apatite concentrate (containing 36 percent P_2O_5, 5 percent MgO, and 1.3 percent R_2O_3), a byproduct of complex polymetallic ore processing, which made it possible to free scarce Khibinsk apatite concentrate, which had previously been processed into defluorinated feed phosphates, and to use it in the production of concentrated phosphorus fertilizers by acid methods.

By the end of the 10th Five-Year Plan the proportion of low-grade raw material used in the production of fertilizers and feed phosphates will be about 25 percent. Given the total increase in production of phosphorus-containing fertilizers and feed phosphates planned for the 11th Five-Year Plan, in comparison with the present five-year plan the proportion of low-grade phosphate stock used in mineral fertilizer industry will grow even more.

In the 11th Five-Year Plan, in addition to developing the use of the indicated forms of phosphate resources, we will be developing the Chilisayskoye deposit, the ore of which contains 24 percent P_2O_5 and 2 percent Fe_2O_3. In the next decade we will also have to develop the Oshurkovskoye, Beloziminskoye, Seligdarskoye, Belkinskoye, and a number of other deposits, and begin processing their phosphate stock.

The Ministry of Chemical Industry devotes considerable attention to producing concentrated ordinary and complex phosphorus-containing fertilizers with good physicomechanical properties. In the last 15 years the concentration of phosphorus fertilizers has risen, and the proportion of complex and granulated fertilizers has risen (see table).

Improvement of the Qualitative Indicators of Phosphorus-Containing Fertilizer

Indicator	1965	1970	1975	1980 Anticipated
Average concentration of phosphorus-containing fertilizers, %	19.11	26.63	35.6	38.3
Proportion of complex fertilizers, %	2.3	11.11	37.1	57.3
Proportion of granulated, %	31.8	51.2	72.8	89.6

These indicators are to be increased further in the next five-year plan. The proportion of granulated fertilizers will be increased by introducing new production operations manufacturing all of their products in granulated form, and by rebuilding and reequipping existing production operations producing powdered fertilizers (superphosphate). The better qualities of phosphorus and complex fertilizers make their bulk transport and dry mixing possible, and simultaneously they improve storage and use qualities, which means a significant economic impact for the national economy. In 1976-1980 a large number of phosphate-containing products intended for agriculture earned the Seal of Quality: ammophos, complex mixed fertilizers, double superphosphate with boron additive, and defluorinated feed phosphates.

The granulometric composition of all phosphorus-containing fertilizers was standardized in the present five-year plan in coordination with agricultural authorities. To permit broad introduction of dry fertilizer mixing, the granulometric composition must be standardized similarly for nitrogen and potassium fertilizers; the proportion of the latter produced in granulated form will have to be increased as well. In order to increase the availability of the brands of fertilizer needed by agriculture and to coordinate the plan for their production and use, we would need to initiate an effort to create, within the "Sel'khozkhimiya" system, a broad fertilizer mixing network, since this would be the simplest, most economical, and most flexible means for providing complex fertilizers to agriculture. What we would need to do first of all in this case is to determine the quantity and locations of fertilizer mixing facilities, the volumes and assortment of the fertilizer mixtures prepared, and the volumes and assortment of mineral fertilizers intended to be mixed.

Development of mineral fertilizer production and of other national economic factors has resulted in an increase in the production of sulfuric acid. Despite the fact that about a fourth of the world's sulfuric acid is produced in our country, domestic mineral fertilizer industry is still not fully supplied with this valuable raw material.

Further effort to organize ore decomposition with sulfuric acid is being hindered both by the shortage of sulfuric acid and by the sharp increase (by about 1.5 times) in its consumption for decomposition of low-grade raw material, in comparison with the amount used to decompose apatite concentrate. This makes it urgently necessary to introduce acidless methods for producing phosphorus fertilizers, and methods permitting a decrease in sulfuric acid consumption.

Among the first methods, we should turn special attention to acquisition of fertilizer thermophosphates. Fertilizer thermophosphates are insoluble in water, but they are readily assimilated by plants. Their effectiveness in soil has been studied well in the Soviet Union. Agricultural chemists have demonstrated that thermophosphates with a particle size of up to 2 mm are highly effective in soils of the nonchernozem zone, and especially in soddy-podzolic soil, in which they are not inferior to superphosphate. The Ministry of Chemical Industry has proposed organizing their production at a volume of about 1.2 million comparison tons for use in acid soils.

A new phosphorus fertilizer (superphos) obtained by decomposition of phosphorites by phosphoric acid and containing not less than 50 percent total phosphorus in water-soluble form is highly promising. Consumption of sulfuric acid per unit of P_2O_5 is 20-25 percent less for production of superphos than for double superphosphate. The procedures for producing these fertilizers have been worked out with experimental plant and industrial facilities. Fertilizers with this composition have been studied rather extensively abroad, particularly in the USA, India, and Bulgaria.

The results of the experiments have shown that combination of readily assimilable and poorly soluble phosphorus in fertilizer satisfies the demand of agricultural plant for this element well, both in the early and late phases of growth. We can come to the same conclusion by examining the results of experiments performed by the All-Union Scientific Research Institute of Fertilizers and Soil Science, the Timiryazev Academy, and the Scientific Research Institute of Fertilizers, Insecticides, and Fungicides imeni Ya. V. Samoylov. About 2.2 million comparison tons of this new fertilizer may be effectively used in agricultural production.

If we are to successfully introduce this new form of long-acting phosphorus fertilizer, the USSR Ministry of Agriculture would need to conduct field experiments in different geographical zones on the broadest possible assortment of crops, and determine more specifically the agrochemical effectiveness of superphosphate-phosphorite fertilizer in the principal soil and climate zones.

Extensive use of phosphate fertilizer continues to be an important means for reducing the lack of phosphorus in soil. It should be noted that about 75 percent of all phosphate fertilizer being produced and applied in the world is consumed in our country. Use of phosphate fertilizer is complicated by its tendency to create dust. Chemists have developed and recommended methods for enriching phosphate fertilizer with potassium chloride and superphosphate slurry. Such methods preserve the agrochemical properties and reduce the losses of phosphate fertilizer, which significantly increases the economic effectiveness of its use.

Thus expansion of the assortment of fertilizers in the USSR is proceeding through the use of different methods for processing phosphate resources and obtaining phosphorus and complex fertilizers of varying solubility, to include liquid complex fertilizers. We must concentrate the efforts of chemists, agrochemists, and economists today on determining the sensible ways to develop phosphate fertilizer industry. It would be especially important to thoroughly account for the evolved structure of raw material sources and their specific features, as well as the national economic effectiveness of comparable forms of mineral fertilizers in terms of their production and use. These questions require immediate joint resolution by all interested departments.

11004
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UDC 63.1:631.527

EXPERIENCE WITH THE ACCELERATED INTRODUCTION OF MIRONOVSKAYA WINTER WHEAT VARIETIES INTO PRODUCTION

Kiev VISNYK SIL'S'KOHOSPODARS'KOYI NAUKY in Ukrainian No 2, Feb 81 pp 73-75
manuscript received 8 Feb 80

DRANISHCHEV, M. I., Mironovskiy, Scientific Research Institute of Selection and Seed Growing of Wheat

[Abstract] The Mironovskiy Scientific Research Institute of Wheat Selection and Seed Production has accumulated considerable experience in the introduction of highly productive winter wheat varieties. Several factors are responsible for this rapid implementation: the authority of the Institution of origin, popularity of related varieties showing high productivity, excellent grain quality and ecologic flexibility. The achievements of the Institute and the variety development sections contributed heavily towards their populatity. As a rule, distribution of new seeds occurred along with state-wide evaluation of the seeds. After one year of testing, the promising varieties were produced on a pilot scale. If the second year tests supported the initial findings, other field tests were undertaken: primary seed production, seeding schedule, reactions to fertilizers, etc. If the original indices were retained, the candidate varieties would undergo country-wide testing. Many test farms are normally used in evaluating new seed candidates. This intensified system for the introduction of new seeds into production gave satisfying results. No references.
[528-7813]

UDC 631.523

USE OF WINTER WHEAT MUTANTS IN THE SELECTION PROCESS

Kiev VISNYK SIL'S'KOHOSPODARS'KOYI NAUKY in Ukrainian No 3, Mar 81 pp 15-17
manuscript received 12 Dec 80

ORLYUK, A. P., candidate of biological sciences, and KARAMUSHKINA, L. P., Ukrainian Scientific Research Institute of Irrigated Agriculture (USRIIA)

[Abstract] In connection with the intensification of agricultural production, the requirements toward winter wheat have intensified. New brands are continuously being developed. Development is being aimed at short stem varieties, concentrating on increased productivity, increased photosensitivity, adequate response to mineral fertilization and ground irrigation, resistance to disease and changing atmospheric conditions. Experimental work at the USRIIA has produced new forms of plants suitable for practical selection under conditions of irrigated agriculture. Cross-breeding among newly developed varieties and with the established ones makes it possible to combine high productivity with other desirable characteristics. The short stem of the developed mutants does not restrict productivity of the plant. These mutants make it possible to increase the yield and resistance of winter wheat to various diseases. The short stem mutant KMB-1 was crossed with a number of highly productive brands (Bezosta-1, Dniprova'ka 537, Kavkaz and Odes'ka 51); the Kavkaz cross produced the plants with highest number of grains in an ear, as well as the heaviest and most productive ears. No references.
[529-7813]

UDC 633:11(633:114[illegible]:14):631.527

STARTING MATERIAL FOR THE SELECTION OF INTENSIVE VARIETIES OF SPRING WHEAT AND TRITICALE

Kiev VISNYK SIL'S'KOHOSPODARS'KOYI NAUKY in Ukrainian No 3, Mar 81 pp 17-19
manuscript received 30 Dec 80

MEL'NIKOV, A. F., PATSEKA, D. I. and DUBYNA, O. H., Mironovskiy Scientific Research Institute of Selection and Seed Growing of Wheat

[Abstract] In a search for new highly productive varieties, 516 samples of spring wheat and 200 samples of triticale were field tested during 1974-1979. A number of strains were identified as possessing desirable characteristics: early ripening, high productivity coupled with disease resistance, grain mass combined with ear size, increased protein content in the grains, and resistance to drought. References 2: 1 Russian, 1 Ukrainian.
[529-7813]

UDC: 636.001.5

RESULTS AND PROSPECTS OF RESEARCH ON BIOLOGICAL BASES OF LIVESTOCK BREEDING

Moscow SEL'SKOKHOZYAYSTVENNAYA BIOLOGIYA in Russian No 2, Mar-Apr 81 pp 167-176

[Article by L. K. Ernst]

[Text] Profound qualitative changes have taken place in development of our country's agriculture in the 15 years that have elasped since the March (1965) plenum of the CC CPSU. There has been considerable increase in its material base, specialization and concentration are occurring on a broad scale, and the effectiveness of production is increasing.

This also applies fully to the livestock industry. The general route of development of this sector, as outlined by the plenum, is being successfully followed. At present, virtually all of the egg and meat production of our country is based on industrial technology. More than one-quarter of all swine-breeding products and a considerable share of beef are produced at large complexes and farms of the industrial type. Milk production has been successfully switched to the industrial track. In our country, there are more than 2000 dairy complexes in operation, and their contribution to total milk production is constantly growing. At the same time, the output of marketable livestock products at ordinary kolkhoz and sovkhoz farms is also increasing.

Yet it is apparent that the present level of development of the livestock industry is not meeting the rapidly increasing demands of our people. The greater prosperity of the people and the change to scientifically substantiated nutritional standards have resulted in an increased demand for valuable livestock products, particularly meat products. For this reason, the July (1978) plenum of the CC CPSU, which defined new frontiers for development of agricultural production and transformation thereof into a highly developed sector of the economy, advanced the task of development of livestock breeding to the fore.

Having noted that the typical feature of modern agriculture is intensification of its sectors on the basis of scientific and technological progress, the plenum of the CC CPSU called special attention to the need for increasing the effectiveness of scientific research.

In a speech at the October (1980) plenum of the CC CPSU, comrade L. I. Brezhnev, general secretary of the CC CPSU and chairman of the presidium of the USSR Supreme

Soviet, stated: "Among the issues upon which depends the standard of living of the Soviet people, improved supply of foodstuffs is in first place." The Politburo of the CC CPSU adopted a decision concerning the preparation of a special-target food program, which provides for complex performance of the task of fuller delivery to the nation of high-grade foodstuffs in accordance with scientifically substantiated standards.

The "Main Directions of Economic and Social Development of the USSR in 1981-1985 and the Period up to 1990" formulate the tasks of increasing appreciably the output of the most important livestock products under the 11th Five-Year Plan: bring annual mean milk production to 97-99 million tons, meat to 17-17.5 million tons and eggs to 72 billion units. The entire set of agricultural and biological sciences must play an enormous role in achieving this. This applies to all scientific institutions specializing in agriculture, particularly those working on the biological bases of plant growing and livestock breeding. Intensive use of animals, as provided by industrial technology, makes it necessary to pursue in-depth studies of the biological distinctions of all species of animals, so that they could be used wisely as a means of agricultural production.

It should be borne in mind that the animal itself is the main tool for producing livestock products, whatever the level of mechanization and automation and use of technological resources.

Analysis of existing industrial technologies shows that, even now, there is an inconsistency between the vast technical capabilities of large mechanized farms and the existing productivity of animals, which is related to the inadequate genetic potential of productivity and incomplete utilization of the already created potential of productivity.

Biologists and zootechnicians are faced with the task of developing animals that are capable of high and stable productivity, with good reproduction qualities under conditions of strictly programmed industrial technology of production.

Apparently, the maximum effect from specialization, mechanization and use of chemistry can only be obtained if they are combined with biological factors. Biology and agriculture are closely interlinked. Each major discovery in biology has a strong influence on development of agricultural production. Thus, in the area of livestock breeding, it is enough to mention such outstanding achievements as theory of balanced diet for animals, introduction of artificial insemination of females and technology of milking with machines, use of hormonal stimulants of fertility of sheep and nonprotein nitrogen substances in the diet of ruminants.

In his times, K. A. Timiryazev stated that plant physiology is the biological foundation of rational agriculture. We are justified in stating that animal physiology (along with biochemistry, genetics, molecular biology and other disciplines) constitutes the biological basis of modern industrial livestock breeding. Of course, it would be inconsistent for biological sciences to be oriented solely toward solving today's problems. For this reason, we expect, first of all, that biologists will study and discover new patterns of vital processes in animals, that they will offer suggestions capable of revolutionizing agricultural production and altering its technology on a basically new and progressive basis.

However, it would hardly be correct to set basic research against applied. Basic research often helps find original and serious solutions to important agricultural problems, which is just as important to a scientific team as the discovery of new patterns. Moreover, at the present time the process of approximation or even merging of basic and applied research is taking place in science, which means that the potential practical application of the results emerges already in the actual research process. In this sense, we could discuss different gradations in orientation of basic research toward applied goals: from an overt practical direction to those that are working for the future. It is not a matter of names, but of a creative approach to work, of talented scientific administrators and workers dedicated to science.

We should discuss some of the biological problems of modern industrial livestock breeding. We shall not make a survey of what has been accomplished; rather, it will be an outline of research in the future.

Problems of optimum animal nutrition: The shortage of feed and poor quality thereof, as well as flaws in feeding animals are the two main factors that are retarding growth of livestock products. Because of inferior feeding, no more than two-thirds of the genetic potential of cattle are utilized in our country.

Physiologists and biochemists are directly involved in solving this problem, as they define the biological requirements of feed quality and quality of animal feeding, develop methods for reducing loss in the course of procurement and storage of feed. However, their main efforts should be directed toward the study of factors that cause an increase in effectiveness of utilization of feed nutrients and development of scientifically validated standards for nutrient and energy requirements of animals. It is known that the coefficient of transformation of protein energy into livestock products is low. In dairy cattle breeding it constitutes 20-25%, in egg production it is 20% and in meat production an average of 10-15%.

The coefficient of conversion of energy and feed into products can be raised mainly by means of a more accurate balance of energy and nutrients in the diet, on the basis of in-depth investigation of patterns of metabolism and energy, and regulatory mechanisms thereof. Many studies have beeen conducted in this field, particularly on ruminants. It is necessary to devote more attention to the physiological mechanisms of regulating animal intake of feed (or, more precisely, of the dry substance in their diet) as one of the chief factors limiting productivity. After all, the level of productivity and, consequently, the economic value of animals are largely determined by the level of energy consumed, which depends on feed intake and concentration of energy in it. Unfortunately, the present level of our knowledge does not enable us to trace the causative link between many factors that affect feed intake.

One particularly pressing problem is to furnish nutrients to highly productive cows during the dry period and start of lactation. It is known, that a cow is able to consume the required amount of dry matter with the appropriate concentration of metabolic energy only 3-4 weeks after calving. This shortage (up to half of all energy expended to produce milk) is compensated by reserves. There is mobilization mainly of deposited fat, as well as a labile reserve of protein of parenchymatous organs, intestinal wall, involuting reproductive organs and, in part, muscles, deposited at the end of the lactation period and dry period. The

mechanisms involved in accumulation and utilization of tissular reserves in cows have not been sufficiently studied. Evidently, they are genetically determined to some extent, but also influenced by many physiological factors (fatness at calving time, body weight, concentra'ion of energy in feed and others).

Feed intake is an important but only first stage of the complex process of energy metabolism in the organism. The studies conducted in the last 25 years in different countries of the world yielded much information about energy metabolism of farm animals as a function of level of productivity and nutrients, and this led to new conceptions of energy requirements. As a result, a new system emerged for rating the energy value of feed, which has two main parameters: 1) animals' energy requirements as related to productivity and environmental conditions, and 2) energy value of feed and rations. Both parameters are expressed in the same units, and they are interrelated.

In the GDR, a system of feed energy units was developed and is in use, which is based on net energy of fats for cattle, sheep, pigs and fowl. The British system for ruminants is based on parameters of metabolic energy of feed and animal requirements for metabolic energy; the Dutch and American (California) systems for cows take into consideration net energy for milk production, and for growing young livestock they consider net energy for maintaining life and growth.

In the opinion of Soviet scientists, the system of rating feed and setting feeding standards according to metabolic energy is the best and physiologically warranted. This system has already been adopted for fowl and swine.

We do not yet have experimental data to substantiate our own system. However, it is also apparent that the old rating system, based on the oat feed unit no longer conforms with the modern level of science and practice, and use thereof hinders further increase in animal productivity. It is imperative to complete the development of a new system, and experimental refinement thereof should be effected in the very process of adopting it.

It is necessary to continue the search for means of reducing unproductive expenditure of energy with heat production and methane in ruminants (which constitutes 50-75% metabolic energy), to study conversion of feed energy to the level of metabolic energy (particularly in the rumen system), as well as absorption of energy constituents and their involvement in overall balance of energy in the organism, role of nutritional and hormonal factors in utilization of energy for production and storage in animals.

In the applied aspect, there must be development of economical regimens for energy nutrition of animals, and a search must be made for new energy resources for the livestock industry. Thus, in the last few years, there has been a great increase in interest in the question of setting standards for lipid nutrition of animals, studies of the role of lipids as energy constituents and specific factors of growth, development and reproduction.

It is important to determine the fat requirements of young and adult animals (particularly ruminants), optimum means of processing and using lipid-containing feed and waste from the fat industry, forms and dosage of lipids in milk substitutes and commercial mixed feed.

One of the pressing tasks in the livestock industry is to develop effective systems of feeding ruminants with conservative outlay of grain and concentrated feed. In this regard, the problems arise of increasing digestibility of nutrients in cellulose-rich coarse feed.

The problem of processing complex carbohydrates and, first of all cellulose [fiber], is related to the problem of increasing assimilation of nutrients and concentration thereof in the diet. This problem has been named as one of the most important and promising ones in the plans of research institutes specializing in agriculture in the United States and a number of other countries. This is not by chance, considering the every increasing amount of this carbohydrate in the plant growing sector. Recovery of digestible carbohydrates from cellulose in the course of processing feed makes it possible to solve the extremely important problem of balanced sugar and protein levels in the diet of ruminants, to which both productivity and reproduction level are related. Diets without balanced sugar and protein content lead to impairment of metabolism and, consequently, to reduction of the time animals are used. In this regard, methods of recovering and using in the livestock industry hydrolyzed sugar from wood pulp and peat, as well as methods of industrial processing of straw merit attention. The cellulose of straw can be broken down in order to convert it into a better form for ruminants or to release the energy contained in it by means of thermodynamic, electrohydraulic, mechanochemical, therrochemical and hydrobarothermal methods, as well as enzymatic hydrolysis with the use of cellulose-digesting microflora. Physiologists and biochemists must study the effects of the methods of processing straw on digestion of cellulose and elements of destruction thereof in the rumen, species composition and activity of cellulosolytic microflora, correlation between fermentation products and, first of all, volatile fatty acids. In this respect, the biological evaluation is decisive.

The system of feeding animals changed with introduction of industrial methods of production; there are new methods of processing feed, which involve alteration of their physical properties (granulation, pelleting). The task for physiologists and biochemists is to conduct an in-depth study of the effects of physical form of feed on digestibility and assimilation of nutrients.

We can expect maximum expression of the genetic potential of animals and effective utilization of feed by them only if there is an optimum correlation between energy and protein in the diet.

In spite of the steps that have been taken, the problem of feed protein is still acute. A large amount of concentrated feed is used unproductively because of unbalanced diets, with respect to protein, particularly high-grade protein. The main reserves in this regard are to increase production of plant protein, use untraditional protein feed, as well as feed supplements derived from chemical and microbiological synthesis.

In our country, steps are being taken to increase production of leguminous crops and perennial leguminous grass. This will reduce the protein shortage in the livestock industry. At the present time and in the foreseeable future, there is a particularly acute shortage of first-class protein of animal origin, without which it is difficult to balance diets for swine and fowl, whereas in fur farming such protein is the basis of the diet. In view of the more refined systems for

processing meat and fish, an increasing share of these products will be processed into foodstuffs. The question arises of searching for new, untraditional sources of first-class protein, equivalent in qualities to protein of animal origin.

Production and use of microbial protein is considered to be a large resource for supplying high-grade protein to the livestock industry. It is close to feed of animal origin in amino acid composition, and production thereof is based on virtually unlimited resources. A promising route is cultivation of yeast on ethanol and methanol, production of biomass of microorganisms cultivated through oxidation of methane, hydrogen and other gases. In-depth investigation of the effects of these products on animals, routes of conversion thereof in their organism, determination of optimum doses and development of feeding methods constitute an important task for biologists.

Silt can serve as a large protein reserve. At the present time, about 300,000 tons of silt containing 40-50% microbial protein is produced at enterprises in the paper and pulp industry.

The problem of protein for the livestock industry must be resolved, not only by increasing production of protein feed, but improving the effectiveness of its use. In this regard, there is an interesting new conception of evaluating protein nutrition of ruminants. It is known that one can obtain effective utilization of nitrogen by ruminants in two ways: preventing breakdown of high-grade plant proteins in the rumen and intensification of synthesis of microbial protein from nonprotein nitrogen compounds. This is the basis of the conception of evaluating nitrogen nutrition of ruminants according to so-called metabolic protein, i.e., protein that is submitted to postruminal digestion and absorption. In essence, this means that conditions for utmost utilization of inexpensive sources of protein by the microflora are created by selective regulation of fermentation in the rumen, while valuable proteins of the main feed and supplements are protected from breakdown by means of processing, as a source of essential amino acids. The new rating method makes it possible to take into consideration changes in solubility of protein, its resistance to dissociation, rate of passage through the first compartments of the stomach when dried, ground, pressed, granulated or pelleted feed is ingested. It can be used to predict the desirability and effectiveness of inclusion of synthetic sources of nitrogen in various diets for ruminants.

Let us also consider the problem of amino acid nutrition for ruminants. It is known that it is not enough to provide amino acids by means of bacterial synthesis in the first gastric compartments for maximum productivity of highly productive cows (unlike cows with average productivity). The main limiting amino acid is methionine and, under certain conditions, other amino acids. The requirements of ruminants with regard to these amino acids are related to their physiological state (height, pregnancy, stage of lactation). It is in view of this aspect that it is imperative to study the efficacy and mechanism of effects of supplements of chemically and microbiologically synthesized amino acids, as well as to solve the problem of amino acids for ruminants in the light of the "metabolic protein" conception.

The standards for vitamin and mineral aspects of animal diets require substantial correction with due consideration of the advances in theoretical and practical industrial livestock breeding.

With respect to the experimental aspect, such issues as the effect of physiological condition, how animals are kept and fed on their vitamin and mineral requirements merit attention, as well as development of simple and effective tests to assess mineral and vitamin intake by animals, lowering deficiencies with the use of chemically and microbiologically synthesized supplements. Equally interesting is the question of raising the coefficient of utilization of active constituents of the supplements, as well as development and use of complex mineral compounds with specified properties.

One should devote much attention to work on synthesis and use in the livestock industry of physiologically active substances--enzymes, antibiotics, hormones and natural active metabolites for the purpose of improving digestibility of nutrients, increasing productivity, regulating growth and behavior of animals.

It is known, in particular, that chemical supplements with specific antibacterial or antiprotozoan action affect the type of fermentation in the rumen and composition of microflora. Antibiotics (rumensin, monensin) are already being used in other countries, which selectively alter the proportion of metabolites in cattle that is being fattened, as well as substances that inhibit methane synthesis.

The question of preserving the nutrients of feed by chemical methods is gaining more and more importance. At the present time, it is being worked on, unfortunately, without consideration of the effects of preservatives on ruminal microflora. However, most preservatives are based on bactericidal action, and if this is not borne in mind the problem would be resolved unilaterally. Moreover, in this case, preservatives may be recommended that have an adverse effect on ruminal microflora, and this would lower or totally preclude the preserving effect.

Biological problems of breeding livestock. The breeders of our country have been given the task to develop new types of animals in a short time: cows with milk yield of 6000-7000 kg and 3.8-4.0% fat content; young bulls that would reach 500-550 kg at 18 months of age; swine with weight gain of 700-750 g per day with outlay of 3.6 feed units per kg; breeds of hens laying 280-300 eggs per year; sheep with yield of 3.2-3.5 kg wool with pure fiber.

It is not an easy matter to develop new breeds, type and strains of livestock with genetically stable high productivity, even with individual feeding and upkeep of cattle. It is even more difficult to develop a breed with high productivity in the case of group upkeep and unified feeding. New, high-speed breeding methods are needed, that would be based on the achievements in population genetics, physiology, biochemistry, molecular biology, etc.

It is common knowledge that variability of commercially valuable and biologically useful characters and properties is determined by genes and blocks of genes. But expression of any quantitative character in the phenotype is the result of a long and complicated chain of metabolic processes that cause formation thereof. They may take place in the same fashion or in many variants. In order to identify genes and blocks of genes one must identify the proteins whose synthesis they control. It is expressly here, on the borderline of concerns of geneticists and biochemists, that a new scientific direction emerged--biochemical genetics.

While in the past, in developing animal breeds, the task of comprehending the biological essence of high productivity was not formulated because of inadequate

theoretical knowledge, at the present time breeding must be performed on the basis of causatively determined physiological and metabolic correlations.

At the present time, the degree of heritability of the most important bred characters (milk yield, fat and protein content of milk, etc.) has been studied rather well. These are all complexly determined characters, in the determination of which many processes in the organism are involved. For this reason, it is a pressing matter to study the degree of genetic determination of expressly these processes, not only the ultimate manifestations of a character, but the nature and integrating interaction of which determines the level of productivity and quality of product. Much is still unclear in this area. For example, several years ago breeders were convinced that the fat content of milk is a character that undergoes relatively little change under the influence of nongenetic factors. It is only after studies of the role of volatile fatty acids in formation of fat in milk were made, as well as investigation of diets that depress formation thereof, that it was established that feeding factors have a strong influence on fat content. This confirms, once more, the need to activate current work of geneticists and biochemists.

Knowledge about these basic processes would enable us to define the range of functional capabilities of biosynthesis, the conditions under which there is full expression of the genetic potential, as well as to determine the critical stages and limiting factors of biosynthesis that could be regulated. In this respect, close interaction between institutes specializing in different fields is very important, and we refer, first of all, to the All-Union Scientific Research Institute of Physiology, Biochemistry and Diet of Livestock (VNIIFBiP) and the All-Union Scientific Research Institute of Livestock Breeding and Genetics (VNIIRGZh), which unfortunately do not interact as yet. Much can be expected from businesslike and active collaboration between scientists in institutes of VASKhNIL [All-Union Academy of Agricultural Sciences imeni Lenin] and institutions of the USSR Academy of Sciences. We refer, in particular, to implementation of the complex program, "Molecular and Biological Bases of Productivity of Livestock Farming," prepared by the Interagency Council for Problems of Molecular Biology and Molecular Genetics, with the participation of VASKhNIL. It is believed that proposals for predicting and increasing animal productivity will be developed in the future, on the basis of basic research on formation of constituents of meat, milk, eggs and wool.

With regard to meat productivity, there will have to be studies of genetic determination of parameters of muscle cells (in particular, number of nuclei), age-related times of proliferation of fibers, regulatory and limiting factors of biosynthesis of muscle protein at different stages of ontogenesis in animals of different species and breeds. One must also put on a firmer methodological and experimental footing the studies of chromosomal sets of different breeds of beef cattle, structure and functional activity of chromatin and determine the possible specifics of hormonal status and endocrine regulation of metabolism as related to differences in intensity of growth and early maturation of animals.

With regard to egg productivity, it is planned to develop methods of induced parthenogenesis and polyploidy, and to perform genetic cloning on this basis. There are also plans for a vast spectrum of studies of processes of proliferation and differentiation of cells and tissues of the oviduct, factors regulating and limiting biosynthesis of egg constituents (white, yolk, shell).

In the area of biosynthesis of milk constitutents, interest will have to be focused chiefly on processes of differentiation and hormonal regulation of mammary gland cells, composition and structure of milk proteins and lipids. Butterfat must draw special attention, since this parameter has dropped in recent years in the nation as a whole. It is imperative to continue with studies of mechanisms of synthesis of butterfat, nature and localization of fatty acids in the triglyceride molecule as related to genetic features and nature of nutrition, determination of causes of decline of fat content when on fat-depressing diets.

Thus, studies in the field of molecular biological bases of biosynthesis will aid in solving the problem of improving the quality of livestock farming products: increasing nutritiousness of meat, butterfat and milk protein, improving technological properties of milk, strengthening egg shells, improving the quality of hides, wool and astrakhan fur.

Problems of biology of animal reproduction: For the last few years, the reproduction of cattle in our country has been on an inadequate level. Calf yield constitutes 76-79 per 100 cows. Specialized raising and fruitful insemination of heifers, as well as intensive use of cows by means of more frequent calving, are the principal means of intensifying reproduction.

The methods developed in our country for long-term storage of studbull sperm are a major achievement of Soviet biological science, which served as the basis for large-scale breeding in dairy cattle farming and increased significantly the effectiveness of all pedigreed breeding work.

Some advances have also been made in solving the problem of preserving gametes of rams, boars and male fowl. However, there are a number of unresolved problems, which are delaying adoption of a system of large-scale breeding in these sectors of livestock farming. In the next five years, these problems will be solved by using the latest investigative methods.

Modern methods are being introduced for effectively influencing the reproductive system of female animals. This became possible because of the comprehensive studies of distinctions of reproductive functions of animals, their systems of neurohumoral regulation of reproduction, discovery of releasing hormones and prostaglandins.

Methods of early determination of pregnancy according to levels of progesterone in blood and milk, synchronization of rut and ovulation, and transplantation of embryos have gained practical use. The wide-scale introduction of the transplantation method would make it possible to obtain from genetically valuable specimens, within a short period of time, entire herds of highly productive animals, to produce twins from beef cattle, to regulate the sex of offspring, to create storage banks for genetic material and thus transport embryos, rather than animals. This process includes procedures for inducing superovulation in donor cows with the use of exogenous gonadotropins and prostaglandins, fertilization of the ovum and transplantation of embryos to recipients.

An even more attractive prospect is to obtain oocytes from immature ovaries and subsequently induce their maturation in vitro. Successful cultivation of at least 1% of the many thousands of ovarian follicles, yielding perfect oocytes, and fertilization thereof would result in hundreds of embryos from one animal.

Coordinated work in this direction is being pursued by VNIIRGZh, VNIIFBiP and the All-Union Institute of Livestock Farming (VIZh), and some rather interesting results have already been obtained. We should intensify in every possible way these promising studies, which are presently being deployed in many countries where livestock farming is well-developed.

Separation of embryos into blastomeres and transplantation to recipients to obtain monozygotic twins is another possible way of producing a large number of embryos in genetically valuable cows. The main difficulty in this area is to develop objective criteria for determining the viability of embryos.

Methods of enucleation of ovicells and zygotes, and introduction into an ovicell of the nuclei of somatic (i.e., not sex cells) cells of valuable producers, as well as the method of parthenogenesis for mammals, open up vast opportunities. In such cases, variability of offspring is precluded with induced development of the ovicell without fertilization, i.e., all of the specimens will be absolutely identical in appearance and genetic features. It is not difficult to imagine the enormous opportunities this would offer livestock farming.

The biological laboratories of our institutes are working with success on the transplantation problem, and they advanced to the world-wide level of experimental techniques within a short time. However, we must improve the methods for inducing superovulation in donors and synchronizing rut in recipients, the technology for short- and long-term preservation of embryos by means of cryoscopic methods, methods for cultivating embryos in media differing in composition, additional maturation and fertilization of oocytes in vitro; it is imperative to develop objective criteria of embryo viability. All this would enable us not only to create a scientific production base for the technology of embryo transplantation, but would upgrade the entire system of reproduction of livestock.

It is impossible to follow the above-described program for controlling the reproductive functions of female animals without broad use of hormones. Suffice it to mention that the use of the three main types of hormones--progestagens, gonadotropins, prostaglandin F_2 and its analogues--permits complete control of the reproductive cycle of female farm animals. As a result of exact control of periods of rut and ovulation, one can inseminate animals without demonstration of rut, which would alter radically the system for organizing artificial insemination. The hormone methods reduce by 20-30 days the service period for cows and make it possible to move calves into the stock herd at an earlier time. They make it possible to artificially induce labor, i.e., to synchronize this process in producing groups of animals and postpone calving to the daylight hours.

Natural hormones and their synthetic analogues are used extensively to stimulate growth and meat productivity; in a number of countries, entire programs for hormonal control of reproductive function of animals have been developed and are being used. This is aided by the manufacture of highly purified peptide and protein hormones, prostaglandins, radiochemical sets and counters for highly productive hormonal assays in biological fluids.

A biological problem of paramount importance is that of ethology, investigation of animal behavior and formation of behavioral reactions, which would be helpful in normal operation of modern industrial technologies for the manufacture of livestock farming products. In this branch of biological science, a paradoxical

situation developed, where a considerably larger volume of scientific information has been accumulated about the behavior of many species of wild animals and birds than about farm animals. However, the fact that this matter has not been studied enough, particularly group animal behavior, is becoming an appreciable obstacle to improvement of the effectiveness of industrial technology.

Utilization of waste acquires special significance in the case of large-scale industrial production of livestock farming products. This is related to environmental protection and possibility of recycling some of the organic substances in waste for feed products. Research is already being conducted in this direction, and it should involve not only zootechnical specialists, but those in the fields of chemistry, microbiology and other branches of science.

The most important objective under the 11th Five-Year Plan is to augment substantially the output of livestock farming products and improve their quality, to fulfill the food program advanced by the Communist Party, which is one of the main factors in improving the well-being of the Soviet people. Considerable material, financial and personnel resources will be directed toward this goal. Under such conditions, the role of scientific and technological progress in the livestock farming sector will increase.

The series of studies on biological bases of livestock farming, problems of modern genetics, physiology and biochemistry of animals are acquiring special importance; they constitute the basis of breeding work, feeding and upkeep of animals, i.e., the principal factors that determine the level of output of livestock products.

At the June (1980) plenum of the CC CPSU, comrade L. I. Brezhnev stated: "We have assumed such a major task as increasing the effectiveness of production and quality of work. It should always be in our field of vision. In the future too, we must think about how to accelerate scientific and technological progress." One of the factors of paramount importance in fulfilling this task is optimum use of scientific personnel, contact between scientific institutions and a complex [cooperative] approach to solving problems referable to the national economy. Precisely this approach conforms with the distinctive features of the present stage of development of science and with practical interests. Industry expects of scientists some thoroughly validated and well-thought out recommendations on radical problems of modern technology of livestock farming.

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EACH KILOGRAM OF FEED TO BE USED FOR MAXIMUM RETURN

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[Article]

[Text] An Important Time on the Farms

Winter is the most difficult and responsible period in the livestock industry. The successful passage thereof depends primarily on availability of feed for the cattle. If there is enough feed and it is of good quality, there will be no decrease in productivity of livestock; the animals will be healthy and produce viable offspring. In many parts of our country, 1980 was quite inclement with respect to weather, and this had an adverse effect on the state of the feed base. For this reason, preparation of feed, enriching it with missing elements this winter should be given special attention. Science has worked out recommendations that make it possible to improve significantly the quality of procured feed, and progressive farms are following these recommendations with good results.

Many years of experience have shown that the farmers who were able to make optimum use of feed were the first to be successful. A concerned farmer will never give animals feed that is unprepared; he will also make up rations in accordance with productivity of a given group of cattle and will see that they are adhered to strictly. We have asked the personnel in the editorial office of the journal, KORMOPROIZVODSTVO [Feed Production] to tell our readers about the distinctive features of the current winter and how to make optimum use of the available supply of feed.

At the present time, there are about 100,000 feed shops and feed kitchens in rural areas. The overall capacity of equipment permits production of up to 3.5 million tons of various mixtures per day. However, not all of them are working at full capacity for different reasons, and this results in great losses: feeding animals with fodder that is unbalanced in nutrients on a national scale results in overexpenditure of millions of tons of feed. The task for specialists and all workers in the livestock industry is to see to it that only processed feed is used on each farm.

It is particularly important to provide for optimum use of feed grain with the maximum return [or efficiency]. On many farms, it is often not given in the form of a balancing supplement, but used to make up the shortage of other types of

feed. This is not expedient, either from the zootechnical or economic point of view. It is best to use grain fodder as part of mixed feed. There is also a simpler way to increase the effectiveness of using grain: it can be ground, crushed, chopped, and added to mixed feed. Thus, by chopping corn, barley and wheat, digestibility and assimilation of nutrients is increased by 7-15%.

An even better route was taken in Kuybyshevskaya Oblast. There, the extrusion method is used extensively to process grain fodder. Piglets given extruded feed are sick less often and better prepared for weaning. Extrusion improves the sanitary condition of feed, since the high temperature and pressure destroy fungi and bacteria. There is also drastic increase in assimilation of the husks of grain, which reduces by 20% the loss of grain. One can pass any grain through an extruder, and even use it to prepare a mixture for production of synthetic milk.

Of course, managers will be concerned primarily with the economic aspect. At the Priboy Sovkhoz, which was the first in Kuybyshevskaya Oblast to use this method of processing grain fodder, production of 1 ton of extruded feed costs 3.81 rubles less than processing thereof by the traditional method, i.e., by grinding and steaming. The cost per quintal pork was 13% lower in the group of animals given extruded feed than in the group of pigs fed ordinary feed; the feed cost per quintal weight gain was also lower, while mean daily live weight gain was considerably higher.

Grass meal and cuttings are very nutritional. When powdered grass [grass meal] is added to simple grain mixes (5 to 15% for pigs and up to 30% for cattle), there is better assimilation of nutrients and less outlay of concentrates. But it is less effective if given to ruminants as coarse feed, rather than a concentrate supplement. Grass meal is the most effectively used as part of granular and pelleted feed. Such feed mixes yield 900-1000 g mean daily live weight gain when used to fatten young cattle.

Not infrequently, specialists and farm managers indicate that there is not enough highly nutritious feed to organize satisfactory cattle feeding. They seem to forget the fact that there are several methods available for increasing the nutritiousness of feed and providing a satisfactory diet, thereby reducing the loss of fodder and improving the return on livestock production.

Let us consider, for example, straw. The time has passed when it was believed that straw is not feed and that one should resort to using it only if there as an acute shortage of fodder. Experience gained in both highly developed capitalistic countries and the alliance of socialist nations, including our country, shows that straw is not a bad feed, but it must be used after appropriate processing, rather than in its natural form.

The most popular methods of processing straw for feed are to grind it and mix it with other feed. Before giving it as feed, the ground straw can be enriched with mash, molasses, dregs [spent grains], steamed with concentrates or soaked in 1% salt water at the rate of 80-100 liters solution per 100 kg straw. Good results are obtained after mixing straw cuttings with ground root crops or silage. However, all these methods of processing straw for feed only improve intake thereof, but do not increase nutritiousness.

One can improve the nutrient value of straw by treating it with high-grade lime (calcination) with calcium oxide content of 85-90%. One uses 30 kg unslaked lime

or 90 kg of lime paste, 10-15 kg table salt dissolved in 2-2.5 tons of water. To this solution one can add 10-15 kg carbamide. Treatment in an S-12 mixer with delivery of steam lasts 1.5-2 h.

If there is no feed shop or special equipment, steaming, mixing and enrichment of feed can be done in wooden or concrete-lined containers. In this case, the steaming process is considered complete when the steam from the straw cuttings escapes from under the lid for half an hour.

The technology of calcination of straw without steaming has also been developed. It eliminates, almost entirely, expenditure of fuel and increases labor productivity. With this method, chopped straw is mixed in an S-12 mixer with a solution of lime and mineral supplements for 15-20 min, after which it is unloaded on a concrete platform where it is kept for 1 day. This method saves 50-60 kg liquid fuel per ton straw. A high-grade feed is obtained at low cost.

Calcined or caustic soda can be used to improve the nutritional value of straw. The principle involved in this treatment is quite simple: chopped straw is loaded into a container (but not zinc-coated), soaked uniformly with a solution of chemicals, steamed for 1.5-2 h and used as feed without washing, while it is warm. A total of 40-50 kg alkali and 1 ton hot water are used per ton cuttings.

A unit for thermochemical processing of straw, which is simple in arrangement and reliable in operation, is used at the Kolkhoz imeni 21st CPSU Congress in Krasnogvardeyskiy Rayon, Krymskaya Oblast. It operates in the following way. A PE-0,8 loader is used to load the straw in a stationary KTU-10 feed dispenser, from which it is delivered uniformly through a TZB-30 pneumatic conveyer to a TsOL-12 cyclone installed over a heat chamber. From the cyclone, the straw is fed into a pug mill, to which the working solution and steam are delivered at the same time. The moist straw, heated with steam, then goes to the heat chamber, where it is steamed again for 2.5 h. The working solution is prepared as follows: 40 kg caustic soda, 15 kg table salt and 15 kg urea per ton dry straw. The output of the unit per shift is 90 tons moist feed ready to be given to the animals.

Chemical analysis revealed that the nutritional value of straw increases from 0.25 to 0.53 feed unit per kg feed after thermochemical treatment. There is also a substantial increase in amount of digestible protein, from 5.8 to 14 g, and of sugar, from 8 to 18 g, when scaled to 1 kg treated straw. As a result of such processing, digestibility of straw cellulose increases from 40-45 to 70-75% and that of protein from 23 to 54%. Intake of straw increases by 1.5-2 times. When treated straw was used to feed livestock at the kolkhoz imeni 21st CPSU Congress, the mean daily live weight gain by young cattle increased from 860 to 1037 g, or 21%. The use of straw enabled this kolkhoz to reduce the outlay of other forms of feed and save more than 300,000 rubles per year. Moreover, the increase in productivity of animals because of use of treated straw enabled the kolkhoz to obtain additionally more than 500 tons weight gain amounting to more than 600,000 rubles without additional expense.

In areas where there is virtually no hay or haylage in the diets of cows, but they are given much concentrated feed and silage, the use of calcined straw has a beneficial effect on normalization of physiological state and metabolic processes in the animals. The cows are given 18-20 kg calcined straw per day; young livestock is given 10-12 kg at the age of 6 months to 1 year and 15-18 kg when they are over a year old.

This winter, farm workers will have to take every step to assure a high nutritiousness of feed. In straw, for example, the amount of digestible protein can be increased significantly by treating it with ammonia water or liquified anhydrous ammonia. It is best to treat the straw directly in stacks. The stacks are covered with a canopy of gasproof material (polyethylene film, tarp), and 25% ammonia water (at the rate of 120 ℓ/ton straw) or liquid ammonia (30 kg) is pumped from a tank into the stack by means of a special device consisting of a 3-meter pipe 2.5 cm in diameter, with openings at the end. If the length of the stack does not exceed 10 m, the entire portion of ammonia is delivered in one place, in the middle of the stack, if it is longer, this is done every 5-6 m.

In the wintertime, 2-3 weeks are needed for ammonia to interact with the straw. Then the canopy is removed, the unbound ammonia escapes, and the straw that is free of ammonia odor can be given to animals. It can constitute 40-50% with regard to nutrition in the ration for cattle.

The method of treating straw by means of hydrolysis followed by addition of yeast to enrich it with protein and vitamins is also effecitve. In this case, the straw is placed in containers and covered with 0.1-0.2% hydrochloric acid enriched with trace elements; the container is tightly closed with a lid and allowed to steam for 2-3 h. It is then cooled to 30-35°C and yeast leaven is added at the rate of 3-5% of mass weight. For optimum development of yeast, one should add 100-150 g superphosphate, 150-200 g ammonia sulfate and 2-3 kg syrup or ground beets per quintal feed.

Silage occupies a significant share of winter rations for cattle. Sometimes its quality is poor. Such silage should be given in limited quantities to animals, and if it has a high butyric acid content it should be eliminated entirely, otherwise it would have an adverse effect on the health and productivity of the animals. There is another adverse consequence of using silage of poor quality, and it cannot be overlooked. With the silage type of feeding, cows receive carotene chiefly from silage. But it is only assimilated if there is very little or no butyric acid in succulent feed.

Thus, a low-grade silage creates a considerable vitamin deficiency in the animals. In rainy weather, many farms stocked up for silage very moist mass, and the silage turned out to be of poor quality and overacidified. Feeding such silage to animals could cause acidosis. To avoid this, such feed must be appropriately prepared for use.

One of the important procedures for improving the quality of sour silage is to use it in combination with straw or hay cuttings. Acidity of silage diminishes rapidly when it is mixed with finely cut root crops, and cattle eat mixed feed much better.

An effective means of improving the quality of silage is to treat it with ammonia water, which results in neutralization, on the one hand, and increased protein value of the feed due to conversion of organic acids into ammonia salts, on the other.

Only synthetic ammonia water is suitable for ammoniation of sour feed. It is recommended to use no more than 10 ℓ ammonia water, 25% concentration, per ton silage. At concentrations below 25%, the dosage should be increased. For example,

if ammonia water contains 20% ammonia, rather than 25%, one must use 1.25 ℓ instead of 1 ℓ. 25% ammonia water freezes at a temperature of 55°C, and for this reason it can be used to treat feed in the wintertime in all areas. Diluted ammonia water freezes at higher temperature.

It is best to treat silage with ammonia water at the time it is removed from the silo and loaded into transport vehicles with a rotor loader equipped with an attachment for adding ammonia water.

For manual treatment of silage, ammonia water should be diluted in ordinary water, in a proportion of 1:3 or 1:4. After treatment, the feed is stacked in piles, covered with a layer of untreated silage and allowed to stand until the odor of ammonia disappears.

Calcined soda can be used to deoxidize silage. For this purpose, a 1.5-2% soda solution is prepared (1.5-2 kg/100 ℓ water), and it is used to spray silage on the feed platform. As a rule, about 250-300 ℓ solution is used per ton feed. The silage is mixed and allowed to stand for 1-2 h, after which it is given to the animals.

Acidity of silage diminishes drastically if it is moistened with yeast leaven (2 kg pure yeast per ton feed) and allowed to stand at 28-32°C for 6-8 h.

Water steam can be used to remove free butyric acid from silage. It is recommended to use this method when silage contains 0.2 to 1% or more butyric acid. About 100 kg water vapor is required per ton silage to remove 80-100% of the butyric acid if the feed contains 0.2% of this acid per ton, and if it contains 0.3% butyric acid 150 kg is needed. At higher concentrations of butyric acid vapor must be increased by 50 kg for every 0.1%.

Steam treatment of silage can be performed in tractor trucks [carts], at the bottom of which pipes are installed with openings for steam to exit. The layer of silage to be treated should not exceed 50 cm in thickness. Steam treatment should be continued for 10-20 min from the time it begins to appear on the surface of the silage. After such treatment, the silage is removed, cooled to 30-40°C and fed to the cattle. One cannot leave the steamed silage in piles for several hours, because it would spoil.

After harvesting corn for grain, the corncobs are left, and they can be well-used as feed. They contain an average of 35 feed units and 1.5 kg digestible protein per 100 kg. But cattle do not eat these cobs in their natural form, and they must be chopped with a swing hammer crusher and prepared for feeding. The corncobs are used as ingredients of coarse feed in the production of granulated feed. In this case, they are chopped almost down to meal. They are also added to loose feed mixes, mixing them with concentrates, protein, vitamin and mineral supplements. But it is best to steam ground cobs with straw. In this case, they are crushed to particles 12-15 mm in size. Meal made from corncobs is used to feed adult cattle in amounts of up to 6 kg/day (1-1.2 kg per 100 kg live weight); up to 4 kg per head per day is given to young livestock over 6 months of age, mixed with concentrate, root crops, pulp, silage, molasses and other feed.

Sunflower calathides, which are left after thrashing out the seeds, are not a bad additional source of cattle feed. The dry matter of calathides contains 7.3%

protein, 3.5-6% fat and relatively little cellulose, up to 16%. Before storing them, the calathidia should be dried, otherwise they could mildew and lose their value as feed. Calathides keep well if they are stacked by alternating a layer of dry straw with a 50-70-cm layer of calathidia. One kilogram meal prepared from dry calathidia contains 0.7-0.8 feed units and 60-70 g digestible protein, which has high biological value. The meal can also serve as a mineral supplement; 1 kg of meal contains 3.1-4.2 g phosphorus, which is 4-5 times more than in green feed, root crops and other feed crops.

Because calathidium meal contains a significant amount of fat, it is a valuable constitutent of the diet for highly productive cows and cattle that is to be fattened in intensive raising. Such meal is very beneficial for wool sheep as a source of sulfur. It is recommended that the meal be given in amounts of 3-4 kg per day for cows, 2-2.5 kg for young cattle over a year old, 0.4-0.6 kg for sheep and 0.6-1.2 kg for adult pigs. Meal from sunflower calathidia is given to animals mixed with succulent and coarse feed, or as part of complete-diet granules. It is recommended to prepare the granules with meal from sunflower calathides and corncobs as follows (amounts given as % of mass); 46% corncob meal, 20% sunflower calathide meal, 10% alfalfa meal, 10% leguminous chaff, 10% sunflower grist [or oil cakes], 2% urea, 1.5% defluorinated sodium phosphate, 0.5% table salt. One kilogram of such granules contains about 0.6 feed unit and 65-70 g digestible protein.

Food waste is a good additional source of feed for cattle and pigs. It is submitted to high-temperature drying, decontamination, then mixed with various supplements and granulated. At the Selyuty Sovkhoz in Belorussian SSR, granules for pigs consist (in nutritiousness) of 50% food waste, 7% grass meal and 43% mixed feed enriched with supplements. One kilogram thereof contains 0.9 feed unit and 93.7 g digestible protein. Granules intended for cattle contain (by weight) 37.5% meal from food waste, waste, 12.5% each of grain and straw, 25% stomach contents, 12.5% sunflower hulls; 1 kg feed contained 0.74 feed unit and 60.1 g digestible protein.

Many farms are using with success for feed wood plants, which contain protein, fats, carbohydrates and other nutrients essential to animals, as well as biologically active substances--vitamins, enzymes, protective, antibacterial and hormonal substances. Not only foliate branches procured in the summer, but bare ones cut in the winter are used for feed. In branches of foliate species most nutrients are found at the end of autumn, and in coniferous branches in late winter and early spring. The thicker the branch, the less crude protein and the more cellulose in it. Branches to be procured for feed should have a diameter of no more than 1 cm.

The younger the coniferous needles [or branches], the more protein they contain. Thus, in year-old runners of coniferous plants there is 30% more protein than in 2- and 3-year ones. Pure coniferous needles contain 25% more protein than the "shank" [?]. The needles contain the most vitamin C in the winter and early spring. Fresh runners of foliate species and branches of conifers are ground into particles 2-4 cm in size, and even finer for pigs. The ground green mass is used in a mixture with ground root crops, silage, fresh pulp and other succulent feed, as well as after steaming or chemical treatment.

One can use equipment in standard feed-processing shops, intended for steaming straw, to steam branches and runners. If there is no such shop, one can use steam generators and large wood boxes equipped with a system of steam-distributing

pipes. Cuttings are steamed for 3,5-4 h starting from the time that steam starts to escape from the box. The branches can be fed to animals after 6-8 h. A good effect is obtained from steaming ground branch feed with concentrated feed, chaff, straw and hay cuttings and other feed. Before steaming, it is good to add salt to the mixture (0.5% table salt in relation to weight of cuttings).

Ground steamed branches may be fermented. For this purpose, feed meal is poured over them, warm water (50-60°C) is added, as well as malt, Lactobacillus or mash for leavening (1% of cuttings mass). Fermentation proceeds for 3-4 days, after which the feed is given to animals.

Ground branches can be treated chemically, like straw, and this eliminates tannins and other harmful substances, increasing the feed value of the cuttings. Treatment with alkali solution breaks down the fibrous structure of branches, increases nutritiousness of feed and its digestibility.

One can also make meal out of branches. For this purpose, one uses the equipment designed to mill grass meal. One kilogram of pine needle meal procured in the winter contains 196 mg carotene and if procured in the spring it contains 118 g; 1 kg needles contains 157.5 and 125.3 mg carotene, respectively. Needle meal contains lysine, methionine, tryptophan, histidine and other amino acids. The amount of essential amino acids in needle meal is rather large: 29-32 mg/kg in spruce needle meal and 30-36 mg/kg in pine. With regard to nutritional value, needle meal is close to leguminous straw, but is superior to the latter in biological quality. Meal made from branches is fed to cows, calves, lamb and piglet at the rate of 0.1-0.5 g per kg live weight per day, to cattle being fattened at the rate of 1-2 g and fattened pigs at the rate of 1 g/kg live weight per day.

Before use as feed, fresh needles are put through grinders, so that most particles are 2-3 cm in length, and then through a swing hammer crusher. It is given with mixed feed to adult cows in amounts of up to 3.5 kg, to young cattle up to 1.5 kg and sheep up to 0.6 kg/day.

Well-treated branch cuttings can replace 25-35% of the daily amount of coarse feed in the diet of cattle, sheep and horses. Cattle has to be habituated to branch feed gradually. First, they should be given 1-2 kg/day/head mixed with straw cuttings and other feed; after 4-5 days the full ration is given: up to 5 kg to cows, 4 kg to calves and young animals over 1 year old, 1.5 kg to calves 6 months to 1 year of age.

One of the important tasks for farm zootechnicians and veterinary specialists is to promptly prevent various diseases of farm animals caused by poor quality feed. Spoiled vegetable root crops present a particularly great hazard. As we know, potatoes and potato tops contain solanine, which has a toxic effect on animals. If ingested, not only are there serious gastrointestinal disorders and eczematous skin lesions, but miscarriages and birth of unviable offspring. For this reason, potatoes that have sprouted, are not ripe and stricken by fungus can be used as feed only in thoroughly boiled form and in moderate amounts (the sprouts are removed). The water left after boiling cannot be given to cattle, since it contains much solanine.

The toxic properties of beets and beet tops are attributable to the nitrites that are formed from nitrates when the tubers are left to stand for a long time to cool

after boiling or with improper storage of tops. Thus, boiled beets are quite harmless right after boiling, but become toxic already after 5-6 h, and toxicity is at a maximum after 12 h. Most often, pigs are poisoned by cooked beets. To avoid animal poisoning, it is necessary to bring the beets to a boil rapidly. The cooking process should not last more than 3-6 h. Beets must not be allowed to cool for a long period of time. Only tubers free of soil, which have been washed, should be boiled.

If storage conditions are improper, especially with high humidity and inadequate access of air, the feed is stricken by mold fungi. Most often the hay and straw of leguminous crops are stricken (clover and vetch hay, pea straw). Stricken feed acquires a dark color, unpleasant, moldy, sour or rotten odor. Grain feed stricken with mold has increased acidity.

Feed must be stored properly, precluding exposure to mold fungi, to prevent poisoning by fungi; stricken feed cannot be used for animals, or it must be decontaminated if it is necessary to use it. Laboratory testing for toxicity is an important prerequisite for preventing cases of animal poisoning by moldy feed. Coarse feed, grain and mixed feed that are very toxic are banned for use as feed.

The most popular method of decontaminating stricken grain is to heat it to a high temperature. It is best to heat grain in the AVM-0,4 unit at temperatures of 135-140°C. When using other equipment, the temperature of the heat carrier should be 180-200°C. After treatment, the grain must be checked for toxicity.

When grain is stricken by mold fungi, it is treated with 4% calcined soda solution. One uses 8 l solution, which is prepared before use, per 100 kg grain. Soda is dissolved in warm water and any formed clumps are removed. The grain is wetted down with the solution in a PU-10B apparatus, left to stand for 24 h then dried in an AVM-0,4 unit at 70°C temperature. The shelf life of treated grain is unlimited.

One can use 4% sodium pyrosulfate solution for treatment (8 l per 100 kg grain). When doing such work one should use an RU-60 respirator with a brand V cartridge or gas mask and gloves to prevent poisoning by the sulfuric gas that is discharged. The moistened grain is left to stand for 24 h before giving it to animals. It is forbidden to store decontaminated grain for over 30 days.

When grain is stricken by fungi of the genus Fusarium, it is treated in the apparatus with 10% sodium pyrosulfate solution, also using 8 l per 100 kg, then allowed to stand for 48 h and dried in the AVM-0,4 unit at a temperature of 135-140°C. Shelf life of decontaminated grain is unlimited. Grain is also soaked in 1% calcined soda for decontamination when stricken by this fungus. One uses 2 kg of this agent and 200 l water per 100 kg grain. Soaking lasts 24 h. One can only treat the daily ration of feed at a time. The solution cannot be reused, since fungus toxins remain in it.

When hay and straw are stricken by mold fungi, they are treated with a solution of unslaked lime. One uses 3 kg unslaked lime, or 9 kg lime paste containing 50% water, or 4.5 kg air-slaked lime per 100 kg hay (straw). The lime is first diluted in a small amount of water, then 200-300 more liters are added while stirring. To the prepared solution, one adds 1 kg table salt and the whole is mixed thoroughly. The obtained lime milk is decanted in a tub and cuttings are placed there for 5-10 min so that they are uniformly moistened. Then they are removed and spread over wooden slatted boards for 24 h, then given to animals.

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OPTIMUM USE OF FEED

Moscow ZHIVOTNOVODSTVO in Russian No 1, Jan 81 pp 10-12

[Article by K. Solntsev, Academician of the All-Union Academy of Agricultural Sciences imeni Lenin]

[Text] The competition for providing a worthy welcome for the 26th CPSU Congress has taken on a genuinely national flavor. To provide the nation with more meat and milk is the competition slogan of rural workers. Farm workers are striving to make use of all feed resources with the utmost effectiveness in order to augment livestock productivity. However, the efforts made are not yielding the desired results everywhere. This is largely related to the specifics of feed procured in 1980. These days, the editorial office is receiving many letters, in which readers ask that we tell in this journal how to best use feed to achieve maximum growth of animal productivity.

For this reason, the editorial office addressed itself to Konstantin Mikhaylovich Solntsev, academician of the All-Union Academy of Agricultural Sciences imeni Lenin, director of the All-Union Institute of Livestock Farming, a well-known specialist in the field of feeding farm animals, with the request to answer several questions:

1. What is the distinction of nutrients in feed procured for the current winter, and what is the best way to organize use thereof?

2. Many various recommendations have been published concerning processing of straw for feed. Which methods of processing straw are the most effective and, at the same time, available for mass use?

3. What are the desirable technological procedures to improve the quality of silage that has soured due to high moisture content of base raw material?

4. In the last few years, grain and concentrated feed in general are being submitted to diverse methods of processing in feed shops. What is the effect of such processing?

1. The large amount of precipitations (up to 80 days of rain in some areas) last summer resulted in lowering the levels of organic and mineral substances, vitamins and sugar in feed crops. The increased moisture in raw material affected the composition of nutrients in hay, haylage and silage.

Here, for example, are data obtained from analysis of haylage procured in 1979 and 1980, which was performed in laboratories of the All-Union Institute of Livestock Farming (the haylage for analysis was taken from farms in Podol'skiy Rayon, Moscow Oblast). Levels in absolutely dry substance (figures are percentages for the 2 years mentioned above): 14.6 and 11.0 protein, 22.7 and 32.0 cellulose, 9.5 and 6.2 ash, 4.4 and 1.90 fat, 2.4 and 0.5 sugar, 1.0 and 0.42 calcium. Thus, the haylage procured in 1980 was inferior in levels of nutrients in 1980, as compared to 1979 according to all indicators. There is an analogous situation with regard to nutrients in silage.

One must make estimates (if they had not been previously made) of availability, not only according to credited feed in warehouses, but according to nutritiousness, i.e., scaled to feed units, in order to obtain objective data about feed and degree of availability thereof to livestock at each farm. This must not be done according to tabulated data, but actual nutritiousness as determined by the agrozoochemical laboratories. Otherwise, some farms may find themselves without the needed amount of feed in the last third of the winter period. At many farms, the feed has a high fluid content and is deficient in salts. This is why this winter, as never before, the role of balancing supplements, particularly biologically active substances, has grown.

The practice of enriching the diet with premixed feed has long since shown its high efficacy in improving the biological value of animal feed. However, premixes are used essentially to enrich mixed feed which is not received by all farms. In this respect, the positive experience gained in L'vovskaya Oblast acquires special value; there, they were able to provide complex feed supplements for livestock farms, making use of the capabilities of interfarm mixed feed enterprises. This winter, additional premix production was organized specially for cows in Moscow Oblast, at enterprises in the mixed feed industry. It is produced by the formula developed by scientists at the All-Union Institute of Livestock Farming.

The specialized premix for cows contains the following (per ton filler): 2500 million IU [international units] vitamin A, 270 million IU vitamin D, 2000 g vitamin E, 1040 manganese, 450 copper, 2000 zinc, 176 iodine and 100 g cobalt.

The daily dosage of premix per cow is 40-50 g. This amount costs 3-4 kopeks. As compared to premix P 60-1, this one had a more effective influence on reproductive qualities of cows and their milk productivity. The mean daily milk yield increased by 7-18%, while the service period decreased to 45-70 days, with fewer p[illegible]um complications. It also aided in increasing vitamin A content in colostru[illegible]om 1950 to 3850-4260 μg/g) and in milk (from 35-480 to 800-1320 μg/g), which in turn had a beneficial effect on calf resistance to diseases. In the groups given the recommended premix there was 100% preservation of calves, versus only 63-88% in those using premix P 60-1. When using the premix, one must bear in mind the following: 1) mixed [combined] feed and feed mixes enriched with premix cannot be submitted to heat treatment (steaming, addition of malt, etc.) in order to avoid inactivation of vitamins; 2) in view of the fact that the premix contains

biologically active substances, there may be adverse consequences to cows if the indicated dosage is exceeded.

It is very important for the knowhow gained in organizing premix production in Moscow and L'vovskaya oblasts to be acquired by other oblasts and republics of our country. In this respect, interfarm mixed feed enterprises and organizations, and Sel'khozkhimiya [Administration for Use of Chemistry in Agriculture], which supply feed supplements to the livestock industry, play a decisive role. Of course, organizing production and use of premixes is not the only means of increasing the biological value of feed. Enrichment of the diet directly at the farms, with macroelements and trace elements, use of multicomponent salt pellets, addition to the ration of good coniferous needle meal or fresh needles--all this and many other traditional methods can help effectively in improving the composition of the diet.

Providing animals with table salt requires special checking. Aside from its important role in normal function of mammary glands and the gastrointestinal tract, it is needed to improve the flavor of straw, hay and haylage.

It is known that a high moisture content in feed increases the probability of it spoiling, worsens its quality during storage, and worsens its flavor. All this could have an extremely adverse effect on animal productivity if the necessary steps are not taken promptly.

In this respect, it is imperative to make use of the entire set of methods tested by practice for effectively improving the quality of feed, intake thereof, digestibility and utilization. This work must be constantly checked by the zooveterinary specialists at the farms.

2. Considerably more straw (by 13.3 million tons) was procured for the winter indoor maintenance period of 1980/1981 than for last winter. It occupies 62% of the structure of coarse feed (in mass) and hay constitutes 38%. Straw is a valuable feed source, and 1 kg of dry substance thereof contains as much gross energy as 1 kg grain. At the same time, the productive value of unadulterated straw is rather low, 0.2-0.32 feed unit. Some procedures for processing this feed are able to break down the bond between lignin, hemicellulose and cellulose using chemicals, and to open access for microflora and digestive juices to the plant tissue of straw, thereby increasing its nutrient value.

In all, more than 20 methods have been developed to process straw. Mechanical, heat, chemical and biological methods are used to treat straw, and some recommendations suggest the complex use of several factors.

Some of the methods of processing straw can improve its flavor and thereby increase intake. The harvesting of grain crops last year coincided with a period of much precipitation, and at most farms the straw has a high moisture content and is stricken with mold. Such straw cannot be fed to animals without first submitting it to chemical or heat treatment. Otherwise, frequent diseases among animals are inevitable. This is why the rule of processing all straw through a feed shop, not allowing a single kilogram in the diet without prior effective treatment must be followed this year everywhere, and mandatory at each farm.

Thermochemical treatment of straw became quite popular in recent years. Use thereof improves the flavor, increases nutritiousness of feed and decontaminates it reliably.

This method is the most effective in treatment of straw of poor quality. It is described in detail in all recommendations.

In addition to organizing proper routine work dealing with processing of straw, it is very important to take active and effective steps to prevent future rotting of straw. Treatment of straw ricks with liquid ammonia—30 kg ammonia per ton straw—is a rather effective and tested procedure. Treatment should last no more than 10 days with minus air temperatures and 4-5 days with plus temperatures.

The ricks must be covered with tarp or polyethylene sheets for 4-5 days. A good procedure for preserving straw and improving its quality is to process it into granules. But one cannot make granules out of rotting straw.

3. Last year, much grass, corn and sunflower silage was procured that had a high moisture content. The easiest and best tested means of lowering moisture content of silage is to mix it with cut (3-5 cm) spring and winter straw. One should add 200 kg straw with about 20% moisture content per ton silage with 85% moisture. In this case, dry matter content of feed increases from 15 to 26%. For this purpose, one can also use hay gathered at the late stage of development. Both the hay and straw, having absorbed part of the moisture in the silage, will become softer and consumed more willingly and in larger amounts by animals.

At farms where there is no straw, but there are root crops, we recommend that they be chopped finely and mixed with silage. This also reduces its acidity, but moisture content does not change. KTU-10, RKA-8 and RMM-5,0 feed dispensers are generally used to facilitate feed mixing. Mixing feed is a very important operation; it must be done thoroughly so that there is uniform distribution of straw or hay cuttings over all of the silage.

One should mix silage with other feed 3-4 h before giving it to animals. Hay and straw, when used to lower moisture and acidity of silage, should not be stricken with mold and putrefying bacteria.

4. This is a very important and timely question. Many lengthy studies have been conducted at scientific institutions in this regard, and they warrant the statement that chopping [grinding, cutting into smaller pieces] is a very important element of preparing grain feed for all farm animals and fowl. There is an established milling (cutting) size for grain for each species, age and group of farm animals, with which there is the most complete digestion and assimilation of nutrients in concentrated feed.

For example, finely ground concentrated feed is recommended for calves up to 1 year of age. For other age groups of cattle, the grind should be between medium and coarse. For weaned piglets, the optimum grind is 0.9 mm and for pigs that are being fattened, 1.0-1.1 mm.

Steaming and boiling feed grain does not improve the nutrient value of protein and carbohydrates. For this reason, only poor grade, moldy feed should be steamed. One should not steam mixed feed, since this flushes out and destroys the minerals, vitamins and other biologically active substances. Roasting barley to a light-gold color results in up to 32% loss of lysine due to breakdown and poorer assimilation.

It is recommended that concentrates be soaked with hot water and the wet mix be fed in heated form to prevent loss of concentrates due to dispersion, as well as entering the upper respiratory tract of animals while eating.

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LIVESTOCK FARMING IN 1981

Moscow ZHIVOTNOVODSTVO in Russian No 1, Jan 81 pp 2-3

[Editorial]

[Text] The Soviet nation completed the 10th Five-Year Plan and entered into the first year of the 11th Five-Year Plan in 1981. In the last 5 years, the Soviet people made new achievements in implementing the long-term economic strategy of the Party. There was significant growth of scientific-technological and economic potential of the nation, strengthening of its defense capability, and a vast program of social development was effected. The material and spiritual needs of the working people were better met.

The agrarian policy of the Party is being implemented systematically. Work dealing with further increase in agricultural output was extremely difficult in some parts of our country because of the inclement weather conditions in 1977, 1979 and 1980. Development of livestock farming proceeded under difficult conditions because of the feed shortfall in those years. Nevertheless, thanks to the great help on the part of the State, efforts of rural workers and those in Party, soviet and agricultural agencies, the mean annual volume of agricultural output increased by 9% in 1976-1980, as compared to the 9th Five-Year Plan. The farm workers of Kazakhstan, Kuban', Stavropol'skiy Kray, Kemerovskaya, Novosibirskaya, Orenburgskaya, Volgogradskaya, Dnepropetrovskaya, Zaporozhskaya, Voroshilovgradskaya and other oblasts earned a high rating by the Party and people.

According to preliminary data, the mean annual meat production (dressed weight) increased by 6% in the last 5 years, as compared to the preceding 5-year plan, milk output increased by 6%, eggs by 22% and wool by 4%. There has been an increase in State purchasing of these types of products. Under the 10th Five-Year Plan, the kolkhozes and sovkhozes of Moldavian SSR and Azerbaijan SSR increased livestock product output at the fastest rate.

The October (1980) plenum of the CC CPSU delineated new frontiers for future development of our economy. The plenum of the CC CPSU and fourth session of the USSR Supreme Soviet of the 10th convocation discussed drafts of the State plan for economic and social development of the USSR in 1981 and the USSR State budget for 1981, and approved the appropriate decrees and laws. In his speech at this plenum of the CC CPSU, comrade L. I. Brezhnev offered an in-depth and comprehensive analysis of the achievements under the 10th Five-Year Plan and of the draft plan for the first year of the 11th Five-Year Plan. Tasks have been put to the economy for both the first year and the current 5-year plan as a whole; the means of

performing these tasks were indicated, as well as the steps to eliminate flaws, routes for advancement to new achievements in economic and social development.

Comarade L. I. Brezhnev stated at the plenum: "Among the issues upon which depends the standard of living of the Soviet people, improvement of food supply is in first place." Agricultural workers, those involved in the entire agroindustrial complex, play an important role in reaching this goal. They took the contents of the draft of the CC CPSU on the "Main Directions of Economic and Social Development of the USSR in 1981-1985 and Over the Period up to 1990" as a program of combat action.

Mean annual grain output must be increased to 238-243 million tons, sugar beets to 100-103, meat (dressed weight) to 17-17.5, milk to 97-99 million tons, eggs to at least 72 billion units and fur to 470,000-480,000 tons. Fulfillment of this important program is being assured each day by the intensive labor of farm workers.

It is planned to further increase in 1981 output and purchase of all types of agricultural products. As compared to the annual mean indicators for the 10th Five-Year Plan, meat production (dressed weight) is planned to be increased by 6.8%, milk by 2.5%, eggs by 10% and wool by 2.8%. Unlike prior years, in accordance with the decisions of the July (1978) plenum of the CC CPSU, starting in 1981 a unified [standardized] plan of State purchasing of farm products and raw material has been established for kolkhozes and sovkhozes, without division thereof into a firm plan and overfulfillment levels.

It is planned to augment output of livestock products mainly by increasing the productivity of cattle and fowl, strengthening and making better use of the material and technical base of this sector, improving organization of labor.

In the plan, paramount importance is attributed to augmenting feed production and upgrading its quality. In 1981, kolkhozes, sovkhozes and other agricultural enterprises will have to procure their own feed in a volume of about 130 million tons of feed units. Procurement of hay must constitute more than 67 million tons, silage 243 million tons, feed rootcrops and cucurbit crops about 48 million tons. Pasturage covering about 6 million hectares will be provided with water at the expense of State capital investments, and there will be radical improvement of hay mowing and development of cultivated pastures covering more than 2.3 million hectares. There will be an increase in production of mixed feed and carbamide concentrate at interfarm, kolkhoz and sovkhoz enterprises, and enterprises of the USSR Ministry of Procurement. Special attention will be devoted to meeting the needs of livestock farming with respect to chemical feed substances, vitamins, trace elements, antibiotics, drugs and other supplements.

Interrepublic transportation of pedigreed and upgraded cattle in the amount of 122,600 head, 78,500 head of pedigreed swine and 213,200 head of pedigreed sheep will be implemented through the system of the Soyuzplemzhivob"yedineniye [All-Union Pedgreed Livestock Association], in order to upgrade breed qualities and improve productivity of animals, especially in regions where cattle productivity is still low.

One of the chief prerequisites for successful development of livestock farming and increase in its efficiency is to make use of the advances in science and progressive knowhow. What is inherent in this section of the plan for the current year is

that, along with introduction of progressive technology in production of livestock products, there are indicators for developing herds and large groups of animals with outstanding productivity.

At the same time, there will be further deepening of specialization and concentration of production, refinement of forms of interfarm cooperation. There will be broad development of introduction of flow line-shop system of organizing production of livestock products on the example of L'vovskaya Oblast and Estonian SSR.

Optimum use of feed is of particular importance for wintering cattle. For the nation as a whole, somewhat more feed was procured, as compared to 1979, but its quality is poorer in a number of locations according to the data of agrochemical laboratories. For this reason, steps must be taken in every kolkhoz and sovkhoz for the most economical outlay of feed and processing thereof for animal feed. It is imperative to see to it that the feed rations are balanced in protein, carbohydrates and minerals. It is only on such a basis that one can augment productivity of cattle and fowl. The work at progressive farms shows that, with adherence to zootechnical requirements as to feeding conditions and indoor maintenance of animals in the wintertime, not only does cattle productivity fail to decline, it even increases, as compared to pasture upkeep.

In addition to the public sector, there must also be development of privately owned farms of kolkhoz farmers, blue and white collar workers. All told, gross agricultural output in the private sector constitutes 25%, the figures being 30% for meat and milk production, 36% for eggs and 20% for wool. Privately owned subsidiary farms contain 23.1 million head of cattle, including 13.2 million cows, 15.2 million swine, 29.8 million sheep and goats, and 382 million fowl. The plan for economic and social development of the USSR in 1981 proposes that kolkhozes and sovkhozes will sell the public 14.2 million piglets and 586 million head of young fowl, as well as more than 3.5 million tons of mixed feed from State resources. Kolkhozes and sovkhozes will help the public procure feed, cultivate private plots and sell surplus products.

The subsidiary farms of industrial enterprises can and should make a substantial contribution to the task of better satisfying the public's needs for livestock products. These farms have a considerable potential for organizing animal raising and fattening, making wide use of w[illegible] from the food, meat and dairy, and other sectors of industry, as well as the [illegible] agricultural resources under the jurisdiction of the enterprises.

It must be stated that a number of subsidiary farms in the system of the USSR Ministry of the Food Industry, USSR Ministry of the Meat and Dairy Industry and other ministries are achieving rather good results from year to year in the output of agricultural products. However, we cannot consider satisfactory a situation where ministries, agencies or industrial enterprises, when making the decision to organize subsidiary farms, expect that animals will be provided with concentrated feed from State resources.

This year, as before, considerable material and financial resources are being contributed to development of agriculture. Capital investments into the entire complex of work have been set at 37.3 billion rubles, or 2% more than in 1980. There will be increased delivery to kolkhozes and sovkhozes of powered tractors,

tractor trailers with greater lifting power [or tonnage], self-propelled mower-rollers, machinery for livestock farming and feed production, and other highly productive equipment. A total of 88.6 million tons of mineral fertilizers, or 3.5 million tons more than in 1980, will be delivered to agriculture. All this creates the conditions for stable growth of agriculture as a whole and livestock farming in particular.

The efforts of agricultural agencies, administrators and specialists in agriculture should be directed toward implementing the decisions of the October (1980) plenum of the CC CPSU, statutes and conclusions discussed in the speech of comrade L. I. Brezhnev at the plenum. It is imperative to create the conditions for every farm to fulfill its assignments pertaining to production and sale to the State of livestock products, so that there will be a worthy welcome for the 26th CPSU Congress.

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USE OF ZEOLITE FROM GANITCHI DEPOSITS IN THE FATTENING OF YOUNG CATTLE

Kiev VISNYK SIL'S'KOHOSPODARS'KOYI NAUKY in Ukrainian No 3, Mar 81 pp 44-47
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[Abstract] Many studies have shown the benefits of adding clinoptilolite to the forage of young animals. Recently, large deposits of this mineral were discovered in Transcarpathia. Therefore, a detailed study was undertaken on the effect of this mineral in fattening calves. The experiments were carried out in the 1978 winter/spring period, using 40 young animals of the brown Carpathian variety. The experimental group of animals which, in addition to normal feed, received 3% zeolite with or without 2.5% carbamide actually showed a 6.8-7.7% decrease in body weight, as compared to the controls. Therefore, the mineral proved to be ineffective as a body-building additive. References 6: 2 Russian, 2 Ukrainian, 2 Western.
[529-7813]

UDC 636.2.084.086

USE OF SILAGE IN FEEDING DAIRY CATTLE

Kiev VISNYK SIL'S'KOHOSPODARS'KOYI NAUKY in Ukrainian No 3, Mar 81 pp 41-44
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[Abstract] The goal of this study was to evaluate the effectiveness of feeding dairy cattle with silage prepared from corn grown in different agrobackgrounds:

a medium background of $N_{107}P_{45}K_{45}$ and a rich one of $N_{214}P_{90}K_{90}$. It was shown that the rich agrobackground led to improved yields of corn, however, the silage prepared from it gave no improvement in milk production nor in the quality of milk. The principal reason for this could be due to the low sugar level of the corn grown on rich background coupled with elevated levels of non-protein nitrogenous compounds, which converted to ammonia and acted as a buffer, neutralizing organic acids. This resulted in a poorer quality silage prepared from corn grown on rich agrobackgrounds. No references.
[529-7813]

UDC 638.2.084.522

EFFECT OF INTENSIVE FATTENING ON THE MEAT QUALITY OF HEAVY CALVES

Kiev VISNYK SIL'S'KOHOSPODARS'KOYI NAUKY in Ukrainian No 2, Feb 81 pp 64-67
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[Abstract] The goal of this study was to determine the fattening indices and meat quality of noncastrated, excess breeder calves of the black spotted and red steppe breeds which had undergone an intensive fattening program. Two groups of 15-months old calves were fed to satiety under controlled housing and climatic conditions. The quality of meat was determined 48 hrs after sacrifice. The black spotted animals showed better comparative indices with respect to the final weight and meat coefficient, showing lower fat content. The protein content favored the steppe brand: this meat maintained its appearance much better and did not oxidize as rapidly. Black spotted meat showed better pH indices, meat tenderness and water retention ability. It was better in taste and juiciness. However, the bullion of red steppe beef was better in taste, clarity and aroma. No references.
[528-7813]

UDC 637.121

TASKS OF SELECTION SCIENCE IN FUTURE DEVELOPMENT OF DAIRY CATTLE BREEDING

Kiev VISNYK SIL'S'KOHOSPODARS'KOYI NAUKY in Ukrainian No 2, Feb 81 pp 1-3

NEDAVA, V. Ye., doctor of agricultural sciences

[Abstract] The problems facing the developers of dairy cattle breeding include genetic improvement of the productivity of animals, isolation of new highly-productive lines, and maintenance of artificial breeding potential. Two distinct

phases exist in the selection process of stock-improving bulls: the first includes evaluation of the breeder bulls on the basis of such phenotypic factors as: size, development, constitutional strength, sperm productivity and impregnation ability of the sperm; the second is an extension of the first, when these factors are evaluated on the offspring generations. An important task should be the development of immunospecific blood tests for the purpose of selecting promising breeders. Sperm banks must be organized to assure the availability of the best material for the propagation of selected herds. This will require development of novel cryopreservation methods with lower destruction of viable sperms. Four new highly productive breeds should be further developed: the Zimmental, the black spotted, the red-steppe and the Carpathian spotted varieties, using domestic and imported genetic stocks. Future tasks include development of an automated management system for the selection process. No references.
[528-7813]

UDC 634.04.11:632.937

NEW BACTERIAL PREPARATIONS AND THEIR USE IN FOREST PROTECTION

Novosibirsk IZVESTIYA SIBIRSKOGO OTDELENIYA AKADEMII NAUK SSSR: SERIYA BIOLOGICHESKIKH NAUK in Russian No 10, 1980 pp 63-68

[Article by A.N. Mashanov, V.I. Baranovskiy, A.I. Pakhtuyev, Institute of Forestry and Wood imeni V.N. Sukachev, Siberian Department of the USSR Academy of Sciences, Krasnoyarsk]

[Text] In the solution of problems of boosting the productivity of forests, a major place is given to the protection of the forest from insect pests, which do great damage to forest resources. Dangerous pests to forests include the Siberian and gypsy moths and the pine looper. In the limitation of the number of harmful insects in nature, a big role is played by entomophages and diseases of bacterial and fungoid origin.

The use of entomopathogenic bacteria of the Bac. thuringiensis group in control of insects possesses certain advantages over chemical methods inasmuch as bacterial preparations enjoy selectivity of action on lepidopteran insects and exercise no negative influence on elements of forest biocenosis. But it must be pointed out that certain strains of the Bac. thuringiensis group, as well as of the Bac. tuviensis group, under industrial plant conditions are lysed under bacteriophage action and therefore are not suited for the commercial production of bacterial preparations [1, 2]. Lowering the entomocidic activity affects their ultimate value and the practicability of using them in forest protection.

Research on highly virulent strains of varieties of Bac. thuringiensis is of great scientific and practical interest. We isolated wild strains of crystalliferous bacteria and viruses and prepared bacterial preparations with them as a basis. A mutant strain was obtained through induced mutagenesis, and the bacterial preparation was prepared from it. The entomocidic properties of the obtained strains were established on various insects under field conditions.

The present work presents the results of studies verifying the activeness of bacterial preparations Tuverin-2 and Insektin-2, as well as their combinations with the virus of granulosis in the struggle against the Siberian moth, the pine looper and other forest pests.

Characteristics of Foci of the Siberian Moth

The northern boundary of prevalence of the Siberian moth is to be found in the extreme conditions of Yakutskaya ASSR. Under the deciduous Siberian forest of Yakutiya lie pale yellow frozen soils characterized by the development of a turf horizon. Chemically, typical turf-taiga pale yellow soils are characterized by a neutral or weakly alkaline pH, possessing no negative effect on the preservation of the virus of granulosis in the soil [3]. The zonal prevalent type of vegetation--the lark red-bilberry taiga--essentially consists of Dahurian larch (80 percent).

Yakutiya's climate undergoes sharp changes in the course of the year. July is warmer than January by an average of 50-55°C. The continental character of the climate is extremely clearly manifested in seasonal phytophenological phenomena. In Yakutsk the length of time from the onset of greening to the end of leaf falling amounts to a total of 134 days. There is little precipitation (mean annual amount is less than 250 mm [4]), and according to the indicator of humidification, a part of Yakutiya lies within the limits of a droughty zone.

Foci of the Siberian moth are located in the warm regions of Yakutiya, in the valleys of the Lena and Amga. In the Amga region, 1978 was a flying year for the pest. The ratio of caterpillars of 5-4 [V-IV] and 3-4 [III-IV] ages was 10:1 and in certain sections 5:1. Phenological observations showed that in Yakutiya phenograms of caterpillars differ somewhat from those in other regions of Siberia. Because of late spring, the chief phenological phenomena of pupation, flight of the moths and emergence of the new generation from the eggs occur 10-12 days later than in the southern forest regions of Krasnoyarskiy Kray. In the registration of numbers, by the shaking-off method, it was established that the number of caterpillars of 5-4 (V-IV) ages varies up to 200 on one model tree. Such a quantity of caterpillars can result by the end of June in 100 percent eating of the needles followed by drying out of the trees. Microbiological research shows that destruction from bacterioses and parasites of older-age caterpillars and pupas does not exceed 15-20 percent, including 2-3 percent from granulosis. Spontaneous destruction of the Siberian moth from granulosis has been noted among caterpillars of 6 (VI) age prior to pupation.

A number of authors [5-7] note that the mortality of the insects increases with simultaneous infection of the caterpillars with virus and bacteria. We studied the possibility of using bacterial preparations and the virus of granulosis against the Siberian moth in the extreme conditions of the North.

Over a number of years an outbreak of the pine looper has been observed in Minusinskiy Rayon of Krasnoyarskiy Kray; this resulted in the drying out of the Minusinsk pine forests. The parasitism of pupas on sectors of pine stands amounts to 17 percent. It was interesting to determine the results of the effect of bacterial preparations on this pest.

Materials and Methods

Insektin, Tuverin-2 and Insektin-2 were prepared at the Berdsk Plant according to regulations for the production of a bacterial preparation with the use of various strains of entomopathogenic bacteria.

A mutant strain of Bac. tuviensis RE-20 was obtained in 1972 through combined mutagenesis and the use of physical and chemical mutagens [8].

The vegetative cells of the Bac. tuviensis Re-20 strain are bacilli. The cells are single, double and mobile. After 48 hours there is formed on MPA [meat-peptone agar] an oval spore and a toxic crystal 4-6 microns in length and 1.5-1.5 in thickness on one end of a cell. The cells have peritrichal flagella; they form a film on MPB [meat-peptone broth] and also a sediment. Gram-positive, the colonies on MPA are round, large, grayish-white, flat and shiny; occasionally the edges of the colonies are rhizoid and the consistency of the colonies is pastelike and is easily removed with loops. The mutant strain colonies are much larger than the original strain.

After 48-72 hours of growth, a spore and vapor-spore inclusion is formed in the cells of the mutant strain. The spore is oval, 1.0-1.2 microns in size. The gelatin is not thinned, the milk is not peptonized and does not produce hemolysis zones in the bloody agar, but forms the enzyme lecithinase and acetylmethylcarbinol. Glucose, saccharose and maltose are assimilated. Lactose, galactose, sorbite, dulcide and inosite are not used. Arabinose and xylose are poorly assimilated.

The bacterial preparation Tuverin-2 was obtained on the basis of the mutant strain of Bac. tuviensis RE-20.

Strains forming pigments were isolated from the dead bodies of gypsy-moth caterpillars in Tuvinskaya ASSR. The size of the cells of a one-day culture on MPA was 1.1-1.5 microns. The cells are straight, rodlike, mobile and have peritrichal flagella. During growth on MPA, spores are formed within the cells after 30-48 hours; they are to be found at the center of the cells. The spores are oval and 0.6-0.8 micron in size. By this time a protein crystal is formed on one of the ends; the size of the rhombic crystals is 2.1-1.5 microns and of round ones -- 0.4-0.5 micron.

Colonies on MPA are round, large; the edges of the colonies are wavy and the surface of the colonies is dull and close-grained. On the third day, the diameter of the colonies is 6-10 cm. The cells multiply by fission. The colonies are cream-colored. The colonies and the medium do not intergrow, they form a brown pigment, which penetrates the medium. On MPA, growth is good, and the colonies form a surface film and a uniform turbidity. Good growth is observed on pieces of potato. The colonies are moist; the lusterless cultures produce browning of the potato.

The relation to oxygen is that of a facultative aerobe. The maximum strain growth is observed when T = 26-30°. Milk peptonizes with the formation of a coagulum. The strain thins gelatin uniformly around the injection; uniform opalescence [opolestsentsiya] along the column with clearing up at the upper part of the column causes active hemolysis of erythrocytes. Pigment-form strains split glucose, saccharose, maltose, mannite, lactose, rhamnose and xylose with formation of acid. They form acetylmethylcarbinol. They are not antagonistic to Bac. dendrolimus, Bac. insectus and possess high entomocidic properties. We consider the pigment forms as a variety of bacteria of the Bac. thuringiensis group, forming a brown pigment. On the basis of pigment-forming strain No 59 [8], the bacterial preparation Insektin-2 has been produced under industrial plant conditions.

Cultivation was done according to the rules for the commercial production of the bacterial preparation Insektin on an industrial-plant nutritive medium. The titer of the preparation consisted of 30 billion microbic cells per gram of powder. The entomocidic activity of the bacterial preparations was verified under laboratory and production conditions against many forest pests. Morphology of the virus and character of affection of tissues were studied with the aid of an UEVM-100-1 electron microscope.

Under laboratory and field conditions, the insects were infected by applying to the branches of the larch suspensions of bacterial preparations and the granulosis virus of a certain concentration. The bacterial preparations Insektin-2 and Tuverin-2 were tested in 1, 2, 3, 0.2 and 0.5 percent concentrations. The granulosis virus of the Siberian moth, arbitrarily called virus Ya, was obtained from sick caterpillars removed from a focus. At the same time the granulosis virus of the Siberian moth, isolated in Tuva (and arbitrarily called virus T) was also tested. The titer of the virus was $2 \cdot 10^9$ in 1 milliliter. The bacteria and viruses were applied in suspensions to branches of the larch with the aid of a spray, after which gauze covers (small lanterns [phonariki]) were put on the branches. Depending on age, 20-50 caterpillars of the Siberian moth were placed in them. The destruction of the caterpillars was recorded every 3 days for a period of two months, and the average percentage of destruction of the insects was determined.

Under production conditions, the infection was carried out with the aid of an AN-2 aircraft, utilizing the method of massive spraying of different working solutions (25-40 l/ha). The equipment installed on the aircraft provided fine droplet spraying of the bacterial suspension. The working solution was loaded onto the aircraft with the aid of an MP-800 A motor pump.

The technical effectiveness of the preparations was determined by the fall from model trees on gauze canopies prior to and after treatment and counting of destroyed caterpillars. In recording the destruction of caterpillars of the pine looper, there were also used control boxes set under the model trees.

Research Results

The results of the experimental studies showed that the time of cultivation varies for the different crystal-bearing strains and fluctuates from 27.5 to 38 hours. The Insektin titer after separation was higher than for the other bacterial preparations, although the fermentation process was identical for all the strains (Table 1).

Infecting caterpillars of the Siberian moth of 1-2 [I-II] age with Tuverin-2 and Insektin-2 resulted in the destruction of 96.2 and 97.7 percent of the caterpillars, respectively. At the same time, destruction from granulosis was equal to 11.5 percent. The destruction of caterpillars of 3-4 [III-IV] and 5-6 [V-VI] ages from combined infection with virus T and Ya fluctuated from 91.5 to 92.5 percent among 3-4 [III-IV] ages and 96.6-97.4 percent among 5-6 [V-VI] ages. Destruction here from the pure preparation of the virus of granulosis Ya was according to the ages 11.5, 25.0 and 22.8 percent (Table 2).

In the combined infection of caterpillars of the Siberian moth, a chronic course of disease is to be observed. The insects succumb over the course of 30-60 days. The shortest incubation period was noted for caterpillars of 2 [II] age to be 10 to 18 days. In bacterial infection, maximum death occurs in the course of 7 to 15

Table 1. Fermentation of Entomopathogenic Bacteria

Strain	Cultivation time, hours	pH	Amin. nitrogen	Glucose	Gornev titer	Sifting titer	Temperature regime	Titer after separation
Bac. insectus	38.0	6.80	75.6	1.18	$2.26 \cdot 10^9$	$2.87 \cdot 10^9$	30-32	65.0
Bac. thuringiensis v. gall.	27.5	6.65	61.6	0.85	$1.87 \cdot 10^9$	$1.75 \cdot 10^9$	30-32	50.0
Bac. tuviensis RE-20	35.0	6.70	68.6	1.00	$1.72 \cdot 10^9$	$1.95 \cdot 10^9$	30-32	52.0
Bac. thuringiensis RE-59	37.0	6.85	67.4	0.80	$1.82 \cdot 10^9$	$1.97 \cdot 10^9$	30-32	44.7

Table 2. Sensitivity of Different Organisms to Entomopathogenic Microorganisms

Preparation	Destruction of caterpillars according to age, %													
	Siberian moth			gypsy moth			Halias chlorana	nun moth	antichnaya volnyanka	ivovaya volnyanka	pine looper	Yakobson moth	bird cherry moth	pierid butterfly
	1-2	3-4	5-6	1-2	3-4	5-6	1-2	1-2	1-2	1-2	1-2	1-2	1-2	1-2
Tuverin-2	96.2	87.4	93.6	91.1	87.7	88.8	90.0	98.8	89.9	91.1	96.4	94.8	94.3	99.2
Insektin-2	97.4	82.1	98.0	96.1	90.0	95.6	86.9	74.4	86.6	86.9	90.4	87.7	95.6	88.8
Tuverin-2 0.2% + virus of granulosis T	96.6	91.5	97.4	---	---	---	---	---	---	---	---	---	---	---
Tuverin-2 0.2% + virus of granulosis Ya ($2 \cdot 10^9$ in 1 ml)	95.0	92.5	96.1	---	---	---	---	---	---	---	---	---	---	---
Virus of granulosis Ya ($2 \cdot 10^9$ in 1 ml)	11.5	25.0	22.8	---	---	---	---	---	---	---	---	---	---	---

Note. Due to the specificity of the virus of granulosis, experiments were not conducted.

Table 3. Effectiveness of Bacterial Preparations in Regard to the Siberian Moth

Preparation	Norm of expenditure on 1 ha		Technical effectiveness, %
	preparation kg	working liquid liters	
Insektin	2.0	40	60.7
Insektin-2	1.0	40	57.1
Tuverin-2	1.0	40	54.8
Tuverin-2 + virus of granulosis	25.0	40	74.1

days. With infection of older-age caterpillars, a significant portion of the insects die in the pupa stage. The figures of Table 2 show that other insects are in varying degree sensitive to the preparations Tuverin-2 and Insektin-2.

Table 3 presents the technical effectiveness of bacterial preparations prepared on the basis of different strains. Insektin has shown comparatively high entomocidic activity when the preparation is used in the amount of 2 kg/ha and Tuverin-2 when the norm of expenditure is 1 kg/ha. The combined use of bacterial preparation Tuverin-2 with the virus of granulosis demonstrated a high mortality for the pest--74.1 percent.

The greatest effectiveness with respect to caterpillars of the pine looper of 1 [I] and 2 [II] ages is found in the use of the bacterial preparation Tuverin-2:

Preparation	Expenditure of preparation, kg/ha	Infected area, ha	Technical effectiveness, %
Insektin	2.0	204	77.2
Tuverin-2	2.0	314	80.7
Tuverin-2	1.0	484	38.7

Conclusions

1. Bacterial preparations Tuverin-2 and Insektin-2 possess high entomocidic activity in regard to many lepidopteran insects--forest pests. Infected specimens die in the stages of caterpillar, pupa and imago.

2. The combined use of bacterial preparation Tuberin-2 with the virus of granulosis exercises an entomocidic influence on the insects throughout the entire duration of vegetation of arboreal plants, suppressing outbreaks of mass multiplication of a pest.

3. A most promising and effective means of protection of forests is to be found in the combined use of bacterial preparations of Tuverin-2 with virus infection in the growth phase of the number of harmful insects.

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7697
CSO: 1840/514

UDC: 619:576.809.7:616.988.43

DYNAMICS OF ANTIBODY PRODUCTION IN THE PRESENCE OF EXPERIMENTAL FOOT AND MOUTH DISEASE

Moscow VETERINARIYA in Russian No 1, Jan 81 pp 38-39

[Article by V. I. Shorshnev, V. P. Onufriyev, M. M. Brokhanov, N. M. Yakovleva and I. A. Pronin, All-Union Scientific Research Institute for Foot and Mouth Disease]

[Text] Studies of the structure and physicochemical properties of globulins with the function of antibodies revealed that specific antibodies may be referable to different types of immunoglobulin and, consequently, they may differ qualitatively in functional activity. After primary injection of antigen in an organism, there is first production of macromolecular IgM antibodies with subsequent prevalence of IgG antibodies (V. N. Kuznetsov, 1968; L. F. Shazhko, 1974; Cowan, 1965; Graves, 1964, and others). With the development of a method of simple radial immunodiffusion (Fahey, 1965; Mancini et al., 1965), it became possible to conduct an extensive study of the quantitative levels of immunoglobulins in a normal organism and in the presence of pathological states.

Our objective was to assay the main classes of immunoglobulins and virus-neutralizing activity of bovine blood serum in the presence of experimental foot and mouth disease.

Aphthous (from cattle) FMD [foot and mouth disease] A_{22} virus was used on 8 bulls 18-20 months of age, weighing 250-300 kg, in a dosage of 10^6 ID_{50} in a volume of 0.2 ml, in two points. Prior to infection, 3, 5, 7, 14 and 21 days after it we took blood from the animals, and serum was tested in the radial immunodiffusion reaction (RRID) by the method of Mancini et al. (1965) as modified by Fahey and Mackelvey (1965). We used monospecific anti-IgG and anti-IgM rabbit serum, which we had obtained previously (V. I. Shorshnev et al., 1978). Immunochemically pure samples of IgG and IgM isolated from normal bovine blood serum, with protein content of 25.0 and 2.5 mg/ml, respectively, served as the standards.

Virus-neutralizing properties of the serum were tested in the neutralization reaction on suckling mice, 5-7 days of age, using the conventional method, with two-fold dilution of serum and a constant ($10^{3.0}$ LD_{50}) dose of FMD A_{22} virus. Before running the reaction, the serum was inactivated in a water bath at a temperature of 56°C for 30 min. The virus-neutralizing activity of serum was expressed in base 2 (log) logarithms. The obtained data were submitted to processing by the method of variational statistics, on the basis of a significance level of $P \leq 0.05$.

Clinical observation revealed generalized foot and mouth disease in all animals 3 days after infection.

Blood serum IgM content averaged 1.3±0.15 mg/mℓ before infection, 1.6±0.11, 2.1±0.43, 2.0±0.09, 4.6±0.12 and 1.7±0.18 mg/mℓ on the above-mentioned postinfection days, respectively. The trend toward increase in IgM was already demonstrable on the 3d day; however, statistical processing of digital data revealed that the IgM increase was reliable only on the 5th and 7th postinfection days ($P<0.05$). Thereafter, the level thereof was in the top of the normal range, as determined before FMD infection.

Mean IgG level constituted 12.9±0.55 mg/mℓ before infection, then 13.2±0.62, 13.0±0.60, 13.2±0.48, 17.3±1.44 and 18.5±0.51 mg/mℓ. The quantitative changes in IgG during the sickness were characterized by slow build-up on the first few days after infection and significant elevation thereafter. The insignificant increase in IgG on the 3d, 5th and 7th postinfection days was statistically unreliable ($P>0.05$), and it was reliably elevated ($P = 0.03$ and $P<0.01$) only on the 14th and 21st days.

Examination of blood serum taken from the animals before infection revealed marked individual fluctuations of immunoglobulin levels. IgM ranged from a minimum of 0.6 to a maximum of 2.1 mg/mℓ, i.e., it more than tripled, whereas IgG ranged from 10.4 to 15.0 mg/mℓ. We were also impressed by the significant variability of immunoglobulin G level in some animals as a function of stage of recovery. In one animal, we observed an increase in IgG from 12.5 to 25.5 mg/mℓ by the 14th day, i.e., it doubled, while in another animal the difference at this time constituted only 2.1 mg/mℓ, and it was statistically unreliable. This indicates that there can be significant fluctuation of potential possibility for immunoglobulin synthesis, and this depends on the individual distinctions of an organism.

Studies of virus-neutralizing activity of the same samples of serum revealed that there was gradual build-up of antibody titers. No virus-neutralizing activity was demonstrated before infection and on the 3d postinfection day. The titers constituted 3.96±0.73 and 6.17±0.67 log after 5 and 7 days, respectively. The highest level of virus-neutralizing activity was demonstrated on the 14th and 21st postinfection days (7.33±0.35 and 7.99±0.17 log, respectively). There was concurrent increase in IgG content and virus-neutralizing activity in blood on the 14th and 21st postinfection days. These data are indicative of predominant involvement of IgG in protection against FMD infection.

10,657
CSO: 1840/530

UDC: 619.576.858.4:576.807.4

STUDY OF LAPINIZED TYPE O FMD VIRUS

Moscow VETERINARIYA in Russian No 1, Jan 81 pp 39-40

[Article by G. V. Gladilin, A. A. Syusyukin, N. I. Yefimov and V. K. Spirin, All-Union Scientific Research Institute of Foot and Mouth Disease]

[Text] We submit here the results of a study of immunobiological properties of lapinized FMD [foot and mouth disease] virus, type O, with consideration of the composition of its population according to plaque size (S character).

In the experiments, we used lapinized type O_1 FMD virus (strains 194, 619, 738, 822) of the 9th-10th passages, as well as epizootic strain O 822, from which small- (SP) and large-plaque (LP) variants were obtained by the cloning method in a culture of piglet kidney (SP) cells.

We studied the viral population by the method of negative colonies (plaques) in a primary monolayer culture of SP raised in vials differing in size (100-150 mℓ). The covering medium consisted of Difco agar (1.2%) in Earle's nutrient medium (pH 7.4-7.5). The appropriate dilutions of culture infected with the virus were incubated, after covering, for 72 h at 37°C temperature. We then evaluated the results, measuring at least 100 plaques. Negative colonies with a diameter of up to 2 mm were considered small, 3-5 mm were considered medium and over 5 mm--large. In addition we considered their morphology (shape, distinction of margins, granularity, etc.).

We calculated the viral titer by the method of Ashmarin and Vorob'yev (1962), and expressed it in logarithms of TCD_{50} and LD_{50} per mℓ of examined material in SP culture and on suckling mice, respectively. In addition, we calculated the titer according to plaque-producing units (PPU/mℓ). Immunogenicity of concentrated GOA formol vaccines was determined in adult white mice and guinea pigs according to 50% protective dosage (ImD_{50}) using the method of the All-Union Scientific Research Institute of Foot and Mouth Disease. Complement-fixing activity of the virus was determined in the complement-fixing reaction.

Antigenic affinity of SP and LP variants was determined in the cross-neutralization reaction on SP culture with guinea pig antiserum using the conventional method.

It was found that the lapinized strains we used differ in proportion of large, medium and small negative colonies in their population (Table 1 [not reproduced]). Strain O 822 produced mainly medium and large plaques, while strain O 619 produced medium ones. Strains O 738 and O 194 were characterized by medium and small

plaques. We failed to demonstrate a link between composition of viral population and its virulence or complement-fixing activity. We found that inactivated virus derived from strain O 738, which has a significant percentage of small plaques, had greater immunizing activity for guinea pigs than the others.

We then tested SP and LP variants of aphthous virus O 822, first bred in an SP culture for 20 passages, on baby rabbits. These viral populations, which were rather homogeneous for the S character, were compared in the cross-reaction of neutralization with guinea pig antiserum obtained with them (21 days). Antigenic affinity between them constituted 95%. The initial variants did not differ appreciably as well with regard to the main immunobiological properties.

The SP population of cultured virus changed in the course of adaptation to the baby rabbits in the direction of large plaques, and on the level of the 5th passage plaque size was at a maximum, constituting 13 mm in diameter. The plaques in the SP culture were characterized by a round shape, distinct margins, presence of clear center and granularly stained peripheral part. From the 6th passage on, we observed gradual reduction in size.

ImD_{50} of the vaccine derived from the original SP variant constituted 0.28 mℓ, while the vaccine from the lapinized variant (8th passage) was less immunogenic (ImD_{50} = 0.78 mℓ), although in this case accumulation of viral antigen was significantly higher than in the original one, according to infectivity titers in the complement fixing reaction. Perhaps these changes were attributable to the new culturing system.

Similar studies were also conducted with the LP variant of virus O 822 (Table 2 [not reproduced]). There was a drastic change in composition of viral population in the first passage, i.e., a decrease in number of LP clones with concurrent increase in medium and small ones. However, subsequent culturing revealed an increase in large colonies in the population of this virus.

Immunogenicity of inactivated vaccine derived from the virus in the 8th passage on baby rabbits was almost one-half the level of the initial variant. The LP variant adapted to baby rabbits faster (according to time of animal death) and its population was less labile, according to S character, than the SP variant, which is perhaps related to the selective advantage of virions inducing formation of large plaques.

Readaptation of the obtained lapinized variants of 8th passage virus to a culture of SP cells (4 transfers) was associated with a change in composition of their populations according to the S character, in the direction of the initial indicator. ImD_{50} of the vaccines derived from "restored" variants constituted 0.36 mℓ for the SP variant and 0.15 mℓ (white mice) for the LP variant. These phenotypic change in the viral population should be attributed to the distinctions of the culturing system. For this reason, when evaluating a viral population according to the S character and relating this parameter to immunogenicity of FMD vaccines one must take into consideration the set of conditions, such as origin of the strain and cultivation conditions.

Thus, the population of lapinized type O FMD virus is not only heterogeneous, but quite labile for the S character. It is only within a few passages that its

composition remains rather homogeneous. We failed to observe any definite correlation between the character of negative colony size in lapinized FMD virus, its infective and complement fixing properties.

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VERIFICATION OF ACTIVITY OF TRIVALENT FMD VACCINE

Moscow VETERINARIYA in Russian No 1, Jan 81 pp 41-42

[Article by V. V. Zheltov, V. V. Sobolev and A.Ya. Samuylenko, Shchelkovo State Biocombine]

[Text] Sufficient data have been accumulated to date to enable us to conclude that the degree of immunity is a function of level of virus-neutralizing antibodies in blood serum of animals vaccinated against FMD [foot and mouth disease] (B. A. Glushko, 1964; V. P. Smertin, 1968; Ye. I. Kovsh, V. D. Barannikov, 1972; A. A. Boyko et al., 1977; Hecke et al., 1959, 1964; Mackowiak et al., 1962; Lucam et al., 1964; Stelmann et al., 1968; Fontaine, Terre, 1971; Pag, 1976, and others). However, in the opinion of these same authors, methods of titrating serum antibodies can be used to verify [check] immunogenicity only after establishing a correlation between antibody level in vaccinated animals and protection thereof when submitted to test infection. Each laboratory must establish such a correlation on its own, proceeding from the method of running the neutralization reaction, animals and cell cultures used for the check, dosage of virus, time of contact between virus and serum, as well as other local conditions and modifications in running the neutralization reaction.

For this purpose, we analyzed the results of test infection and analysis of blood serum from 1867 head of cattle inoculated with trivalent FMD vaccine derived from types O, A and C [or S] FMD virus cultivated on the lingual epithelium of cattle.

Material and Methods

We checked immunogenicity of the vaccine on cattle 1.5-2 years of age, which were first checked for absence of anti-FMD antibodies.

To check one series, we used 60 head of cattle, with 20 head for each valency, 5 of whom were inoculated in undiluted vaccine in a dosage of 5 ml, 5 with 1:4 diluted vaccine and 5 with 1:16 diluted vaccine in the same volume. As a control, we left 5 animals unvaccinated. The vaccine was diluted in immunologically inactive carbonate buffer, pH 7.6. After 21 days, the animals were infected intradermolingually with FMD virus homologous to the commercial one, in a dosage of 10^6 ID_{50} in two points, using 0.1 ml in each.

For titration of virus-neutralizing antibodies, we prepared 4 serum dilutions at intervals of 0.6 log (1:4, 1:16, 1:64 and 1:256). To 1 ml of each dilution of serum we added 1 ml FMD virus adapted to a cell culture in a dosage of 100 TCD_{50}.

The serum and virus were mixed and left in the incubator for 1 h for contact. The mixture of virus and serum was inoculated in amounts of 0.2 mℓ in 6 test tubes with 4-5-day culture of swine kidney cells. For each titration, we ran a control of viral dosage, as well as control with positive and negative serum. The results were evaluated after 48 and 66 h. The antibody titer was calculated by the method of Kerber, and it was expressed in decimal logarithms.

Results

In all, the valency of O 1618 was checked on 649 head of cattle, valency of A_{22}550 tested on 640 head and that of C 564 on 578 head.

The animals were divided into groups, according to levels of virus-neutralizing antibody titer (at intervals of 0.3 log), for each of which we calculated the ratio of protected animals to total number in the group and percentage of protection.

We calculated the coefficient of correlation using the formula for small groups. Equalization of the empirical line of regression was performed by the least squares method: $Y = bX + a$. X refers to the logarithm of antibody titer (log TSN_{50}) and Y to the percentage of animals protected against generalized FMD; a and b are coefficients of regression. For each selected [or sample] indicator we calculated the error and confidence range with probability of P = 0.95.

The data listed in Tables 1 and 2 [not reproduced] indicate that there is a correlation between antibody titer (log TSN_{50}) and percentage of protection for all three valencies. The coefficient of correlation was 0.96 for O 1618 and A_{22} 550, and 0.97 for C 564. Using the regression equations and knowing the antibody titer of inoculated animals, we can find the expected percentage of protection and thus evaluate the quality of the vaccine.

For the tested types of virus, the correlation between logarithms of antibody titers and percentage of protection was as follows:

	50%	70%	85%	95%
TSN_{50}--O 1618	1.05	1.27	1.44	1.55
TSN_{50}--A_{22}550	0.68	1.03	1.29	1.46
TSN_{50}--C 564	0.77	1.00	1.16	1.28

According to the recommendations of the permanent commission of the International Epizootic Bureau (1975), as well as in the opinion of many researchers concerned with the problem of immunoprophylaxis of FMD (Lucam et al., 1964; Fedida, 1971; Ferre et al., 1972), vaccines prepared for prevention of FMD in cattle are considered good, and they can be allowed for use if they create immunity that provides for protection of at least 70-75%. The minimum percentage of percentage does not refer to the result obtained from test infection of a group of inoculated animals, but its lower confidence interval range with probability P = 0.95. In this case, the mean result should usually be at least 85%. Expressly such requirements were set in the technical standards documentation for trivalent FMD vaccine produced by the Shchelkovo Biocombine.

In our experiment, such protection was present in animals with antibody titer of 1.44 log TSN_{50} for type O 1618 virus, 1.29 log TSN_{50} for A_{22}550 and 1.16 log TSN_{50}

for type C 564. In all groups of animals immunized with tested series of vaccines, the mean antibody titers were higher than the titers providing for the minimum permissible level of protection. The geometric mean titer of antibodies, calculated from the results of checking 224 series constituted 1.79±0.20 for valency O 1618, 1.68±0.14 for $A_{22}550$ and 1.69±0.12 for valency C.

The method of titrating virus-neutralizing antibodies is reliable and economically expedient for checking trivalent FMD vaccine. Use thereof makes it possible to use 5 head of cattle, instead of 60 used for testing by the infection method, to test one series of vaccines according to three valencies.

Conclusions

1. The level of virus-neutralizing antibodies in the serum of inoculated animals is a quantitative indicator that objectively reflects the intensity of immunity.

2. For each type of virus, the same degree of animal protection is obtained by different levels of antibodies.

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INDUCTION OF ANTIVIRAL ACTIVITY IN BLOOD SERUM

Moscow VETERINARIYA in Russian No 1, Jan 81 pp 42-43

[Article by V. P. Karpov, L. G. Burba and V. A. Barkhudaryan, All-Union Institute of Experimental Veterinary Science]

[Text] Intensive studies are being conducted in the area of immunology of neoplasms of the possibility of enhancing immunoreactivity and resistance with nonspecific immunostimulators, including adjuvants of bacterial origin. In this respect, microorganisms of the Corynebacteriaceae family are of considerable interest.

Halpern et al. (1977), Cypka et al. (1977) and others, who studied the mechanisms of anticarcinogenesis, demonstrated that the antineoplastic action of Corynebacterium parvum and certain othter Corynebacteria is attributable to activation of macrophages, bone marrow cells and stimulation of interferon synthesis, i.e., factors of cellular and humoral immunity.

Previous studies (V. A. Barkhudaryan et al., 1977; V. S. Gevondyan et al., 1978) established that administration of avirulent strains of Corynebacteria, which elicited a marked oncoprotective effect, drastically increased reactivity of elements of the lymphoreticuloendothelial system of the organism.

Four strains of Corynebacteria (A, B, C, D), isolated from the blood of cows stricken with lympholeukemia, served as material for subsequent studies. The bacteria were cultured in separating flasks, on laminated serum-glucose Hottinger agar (pH 7.4-7.6) for 48 h, then washed off with isotonic sodium chloride solution, successively washed 3 times and precipitated by centrifuging at 3000 r/min for 30 min, obtaining a suspension containing 80-100 billion live bacteria per ml, from which we prepared a working suspension with a concentration of 20 billion bacterial bodies per ml. The concentration of bacteria was determined with a FEKN-57 [photoelectric colorimeter] in cuvettes 3 mm in width, using a No 4 green light filter.

The obtained suspension of Corynebacteria was injected to lambs (first-generation hybrids from the Kalinin coarse-wool breed and Soviet merino) at the age of 3.5-4 months and to rabbits weighing 2-2.5 kg. Before the experiment, we took blood, analyzed it for the main hematological parameters and obtained serum. After 3 days, 5 lambs were given intravenous injections of 100 billion live bacteria, and the injection was repeated after 10 days. After another 7 days, we again took blood and obtained serum.

The lambs were given hypodermic injections of another 100 billion bacteria 30 days after the second intravenous injection, and 7 days later we took blood for

hematological tests, and obtained serum. To a control lamb we gave 3 mℓ bovine serum in a similar manner. We conducted hematological tests and obtained blood serum.

Serum activity was determined with the skin test using variola vaccine in the modification of A. A. Litvinov (1967), according to capacity of blood serum to depress the inflammatory reaction induced by intracutaneous injection of vaccinia, i.e., to inhibit reproduction of the test virus.

In order to run the skin test, we sheared off the fur of intact sheep, on the sides over an area circumscribed cranially by the line of the last rib, caudally by the line intersecting the "golodnaya" [hungry?] fossa, dorsally along the line of the transverse osseous processes of the spine and ventrally, a hand's width up from the xiphoid cartilage. Then this area was shaved, cleaned with 70° iodinated alcohol and left untouched for 2 days. A grid with 3-cm boxes was painted over the shaved skin surface with a felt-tip pen. Determination was made of working titer of vaccinia in preliminary tests on sheep and rabbits. We prepared dilutions ranging from 10^3 to 10^9 plaque-producing units (PPU) per mℓ, and used them for intracutaneous injections in amounts of 0.1 mℓ, evaluating the reaction 24 and 48 h later. A dosage of 10^7 was found to be reactogenic for sheep and 10^5 for rabbits. In this case, there was swelling, with tenderness and erythema 20-22 mm in diameter. The skin fold in the swollen area was 3-5 mm thicker.

The activity of the obtained sera was determined on intact animals (sheep and rabbits) in undiluted form and in dilutions of 1:10 to 1:320 (to 1:80 on rabbits).

The tested serum was injected intracutaneously in amounts of 0.2 mℓ, then 0.1 mℓ vaccinia was inoculated in the same place. The reaction was evaluated after 24 and 48 h. Absence or presence of blocking of vaccinia action was evaluated according to degree of inflammatory reaction (marked swelling and severe erythema; marked swelling and mild erythema; slight puffiness with a scab; scab with or without slight puffiness, absence of erythema).

Undiluted serum of intact sheep also had antiviral activity; however, the antiviral activity of serum from lambs stimulated with Corynebacteria was considerably higher. It inhibited development of the inflammatory reaction in a dilution of 1:10, while serum from lambs stimulated with strains B and D did so in dilutions of 1:20 and 1:40, respectively.

In the experiments with rabbits we used three strains of Corynebacteria, A, C and D. A suspension of each strain was injected to 2 rabbits (intraperitoneally to one and hypodermically to the other) twice: first in a dosage of 15 billion bacteria, then 2 billion bacteria after 7-9 days. Two control rabbits were given two hypodermic or intraperitoneal injections of 2 mℓ 5% ram erythrocyte suspension. Serum was collected 7 days after the second injection of inductor.

We determined the activity of rabbit serum similarly, with the skin method in a homologous system. It was demonstrated that strain A had a good capacity for inducting inhibiting activity. In a dilution of 1:10, the serum depressed completely development of the inflammatory reaction induced by a reactogenic dose of vaccinia.

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MAREK'S DISEASE IN YOUNG TURKEYS

Moscow VETERINARIYA in Russian No 1, Jan 81 pp 48-49

[Article by G. P. Demkin, Saratov Zooveterinary Institute]

[Text] Young chickens are the most sensitive to Marek's disease under natural conditions. We reproduced this disease in experiments on young turkeys. This enabled us to study the dynamics of pathomorphological changes, their link to clinical manifestations of the disease, methods of infection (intramuscular) and upkeep conditions.

We used 40 day-old turkeys (5 of which served as a control) from a farm without any problem with Marek's disease. We used pieces of diseased organs and blood from chicks presenting an acute course of the disease (from a poultry plant stricken with Marek's disease) for infection.

From the material, we prepared a 10% suspension of tissue homogenate with saline. To this suspension we added 2000 AU [active units] each of penicillin and streptomycin per milliliter, then left it in the refrigerator at +2-4°C for 1 h. We used it in a dosage of 0.3-0.4 ml for intramuscular infection.

The experimental and control groups of baby turkeys were kept in isolation in cages. They were examined daily. They were sacrificed 5, 10, 15, 20 and 25 days after infection. Pieces of diseased organs from baby turkeys that had to be sacrificed were submitted to histological examination.

After infection, we observed depression of the baby turkeys, diminished appetite, lameness, but these signs disappeared after 5 days. In the first 10 days, there were 5 deaths in the experimental group due to different causes. We sacrificed 5 baby turkeys 5 days after infection.

Postmortem examination failed to reveal signs of the disease. Histological examination of sections from the infection site revealed edema, hyperemia and neoplastic infiltration of muscle bundles by lymphoid cells differing in degree of maturity. Hyperplasia of lymphatic follicles was demonstrated in the viscera.

Five more turkeys were sacrificed after 10 days, and 4 of them presented typical signs of Marek's disease at the postmortem. There were gray, sebaceous foci in the lungs, liver, intestine, heart and bursa of Fabricius, with infiltrates in the femoral muscle and hyperplasia of the spleen. Macroscopically, the small sites, which were the size of a millet seed, were rich in color, shiny with a hyperemic zone on the periphery.

Histological examination of these sites revealed neoplastic proliferates consisting of reticular, lymphoid and pseudoeosinophil cells, lymphoblasts and prolymphocytes.

By the 15th postinfection day, some of the turkeys presented paresis of the legs and squatting on the tarsus. Of the 5 sacrificed turkeys, 3 presented macroscopic changes. Gray sebaceous sites were evident in the liver, lungs, intestine, heart, bursa of Fabricius and femoral muscle, and there was hyperplasia of the spleen.

The size of these sites reached that of a lentil. They extended above the surface of the mucosa of the colon, and were located at the site of the lymphatic follicles; the intestinal wall was thickened by 2-3 times. At the infection site, the femoral muscles were edematous, lighter in color and enlarged.

On the 20th day, 4 of the 5 sacrificed turkeys presented gray nodules surrounded by an area of hyperemia in the liver, lungs, heart, bursa of Fabricius, femoral muscle and spleen. In the intestine, the foci merged; its wall was 4-5 times thicker than normal. The size of the foci and nodules was up to that of a pea.

We sacrificed 10 young turkeys on the 25th postinfection day. They presented weight loss, emaciation, consolidation of muscles at the infection site, barely noticeable deformity of the extremity, and some presented paresis. There were visible changes in seven of them.

Autopsy revealed multiple focal or diffuse lesions in the internal organs, which were very similar to those observed in experimentally infected day-old chicks. Diffuse lesions were noted in the heart and large intestine.

With regard to frequency of changes, the organs can be put in the following order: spleen, bursa of Fabricius, intestine, heart, lungs, liver and stomach.

No changes were demonstrated in the control baby turkeys.

The most important sign at the site of injection of the material and in the viscera was very marked proliferation of reticular and lymphoid cells (lymphoid, prolymphocytes, lymphocytes, lymphoblasts). The centers of proliferation were distinctly visible and separated from one another.

Later on, these centers lost their distinct outlines, merged into diffuse proliferates and formed massive neoplastic structures. The cellular elements of organs and tissues were replaced with newly formed neoplastic tissue; they underwent atrophy, dystrophy and necrosis.

Thus, when turkeys are infected at the age of 1 day, the disease is acute. This has epizootic implications: chicks and baby turkeys should be raised separately at the same farm.

Marek's disease is not a problem at turkey farms, apparently because turkeys have herpesvirus, which is related to the virus of Marek's disease and creates immunobiological resistance.

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SIMULTANEOUS INOCULATION OF DOGS AGAINST RABIES AND PLAGUE

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[Article by D. D. But'yanov, N. A. Kovalev and V. A. Kirpichenok, Vitebsk Veterinary Institute and Belorussian Scientific Research Institute of Experimental Veterinary Science]

[Text] We describe here the results of developing a method of associated vaccination of dogs against rabies and plague. Experiments were conducted on 230 East European and Caucasian sheep dogs, and local breeds of dogs 3-4 months of age or older.

We used antirabies phenol vaccine and dry virus vaccine against plague of carnivores (mink, sable, fox and dog) derived from attenuated strain 668/KF. We mixed both vaccines in the following manner per 100 animals: We diluted 300 immunizing doses of dry virus vaccine against carnivore plague in 300 ml special bactericidal diluent furnished with the plague vaccine. We added 100 inoculation doses of dry antirabies phenol vaccine.

The vaccine mixture was injected intramuscularly in the [illegible] surface of the thigh in a dosage of 3 ml (one immunizing dose of each vaccine).

The animals were divided into four groups. The first group of dogs was given the mixture of vaccines against rabies and carnivore plague; the second was given rabies vaccine; the third was given plague vaccine. The dogs in the fourth group served as a control (they were not vaccinated).

At first, we determined the viability of vaccine viruses of plague and rabies in the mixture. Viability of plague vaccine virus was determined on the basis of cytopathogenic action using the neutralization reaction in a culture of chicken fibroblast cells; the rabies vaccine virus was evaluated according to retention of its pathogenicity for rabbits.

It was established that when the vaccine strain of plague virus is mixed with antirabies phenol vaccine the former remains viable for at least 72 h and fixed rabies virus for 96 h (duration of observation period).

Thus, the phenol contained in the rabies vaccine does not have an adverse effect on immunogenic properties of the plague vaccine virus within the above period.

Investigation of immunogenesis, time of appearance and duration of immunity after associated immunization of dogs included the following: clinical examination,

daily measurement of body temperature, blood tests, determination of total protein and protein fractions in blood serum, antibody titer in blood serum, plasmocyte reaction in lymph nodes and spleen, ribonucleic acid and glycogen content of peripheral blood cells.

Immunity to rabies and plague was evaluated 4, 10, 14, 21, 150 and 300 days after vaccination, as well as 300 days after revaccination.

We used the Dokshitskiy strain of street rabies in a titer of 3.79 log LD_{50}/0.03 ml to determine immunity to rabies. Experimental dogs were given intramuscular injections, in a dosage of 2 ml, of 10% brain suspension. Some of the animals were infected with fixed virus of the Moscow strain in a titer of 5 log LD_{50}/0.03 ml for white mice. The virus was injected to the dogs intracerebrally in a dilution of 1:1500, in a dosage of 0.5 ml.

Immunity to plague was determined after intramuscular infection of dogs with the Gauyasskiy strain of epizootic carnivore [sylvatic] plague virus in a dosage of 1000 LD_{50}.

On the 2d-4th day after injection of the vaccine mixture some dogs presented insignificant elevation of body temperature to 39.2-39.9°. The temperature dropped to normal after 3-4 days. There were no appreciable differences in temperature reaction to immunization with the mixture of vaccines and separate monovaccines.

We failed to observe a clinically noticeable reaction in the experimental dogs. The animals remained active, reacted actively to their surroundings and their appetite was unimpaired. There was no visible reaction at the site of vaccination.

The number of erythrocytes, hemoglobin and erythrocyte sedimentation rate remained in the normal range after associated and separate inoculation.

With associated vaccination, we observed statistically reliable changes in leukocyte count. First there was insignificant leukocytosis (up to 14,850±200/mm^3; $P<0.01$) then, by the 14th postvaccination day, insignificant leukopenia (8970±390/mm^3).

After 21 days, the leukocyte count was normal. Insignificant neutrophilia was found in the leukocyte formula, referable to stab and juvenile leukocytes. There were analogous changes in dogs immunized with rabies and plague monovaccines.

In dogs immunized with a mixture of vaccines, the number of lymphocytes with a large amount of RNA increased to 8.0±0.87% four days after the inoculation; it constituted 9.6±0.55% after 8 days and 13.3±0.56% after 14 days ($P<0.05$). By the 21st day, the percentage of such lymphocytes was close to normal (5.4±0.57%). The number of lymphocytes with low RNA content decreased to 1±0.25% ($P<0.01$).

We failed to demonstrate any consistent changes in glycogen content of blood neutrophils in the first three groups of animals.

The changes in peripheral blood after immunization are indicative of moderate rate of hemopoiesis, related to immunological changes in the organism.

There was significant change in total protein and protein fractions of blood serum after both associated and separate inoculation. The total protein of blood serum increased (to 7.4±0.04 g%), as did the gamma globulin fraction of proteins after immunization.

There was an increase in level of the gamma globulin fraction to 15.4±0.4% 4 days after combined vaccination, to 17.6±0.3% 8 days after and 18.2±0.3% ($P<0.01$) 14 days after. After 21 days, the gamma globulin level dropped, but did not reach normal (13.3±0.3%).

Concurrently with the increase in gamma globulins there was a decrease in level of blood serum albumin.

During the period of intensive processes of immunogenesis after combined and separate inoculation, there was transformation of immunocompetent cells. At first there was an increase in amount of basophil lymphocytes, reticular cells, blasts and plasmoblasts in lymph nodes and the spleen; then there was an increase in immature and mature plasma cells. This structural change was associated with cytochemical changes: an increase in RNA content of cells.

Antibodies to rabies virus appeared in blood serum in low (0.7 log AU_{50} [active units]) on the 10th day after combined inoculation, reaching a maximum after 30 days (2.2 log AU_{50}), but after 5 months the antibody titer constituted 1.8 log AU_{50} versus 10-100 LD_{50}/0.03 ml fixed Moscow strain of rabies virus.

Antibodies to the virus of sylvatic plague were demonstrable in a titer of 1.2 log AU_{50} on the 10th day, 2.5 log AU_{50} after 1 month and 2.1 log AU_{50} after 5 months, versus 100 TCD_{50}/0.1 ml plague vaccine virus obtained from VGNKI [expansion unknown] with a titer of 4 log TCD_{50}/0.1 ml.

After revaccination after 5 months, the antibody titers for both viruses rose. There was accumulation of antibodies in analogous titers with administration of monovaccines.

The results of tests on 54 dogs revealed that immunity to rabies and plague is formed within 14-21 days after combined inoculation, and the same applies after giving separate monovaccines.

We determined the duration of immunity after associated vaccination of 96 dogs. The experiments revealed that immunity to rabies and plague in dogs immunized with mixed vaccines at the age of 3-4 months persisted for 5 months. After revaccination 5 months later immunity persisted for over 10 months. Analogous results were obtained with the use of monovaccines for inoculation.

Control (unvaccinated) dogs (9 in each group) became sick and died after infection with street rabies virus, fixed and epizootic carnivore plague virus. In the sick dogs there were the typical clinical signs and pathoanatomical changes inherent in plague.

The efficacy of combined inoculation against plague and rabies was confirmed under production conditions on 5700 dogs. There were no cases of rabies or plague for 1 year among the vaccinated dogs.

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INACTIVATED VACCINE AGAINST OVINE BLUETONGUE

Moscow VETERINARIYA in Russian No 12, Dec 80 pp 31-32

[Article by V. A. Sergeyev, N. P. Anan'yeva-Ryashchenko, V. P. Khizhinskaya, R. V. Kosheleva, I. G. Kekukh and T. V. Khlybova, All-Union Scientific Research Institute of Veterinary Virology and Microbiology]

[Text] Specific preventive treatment against ovine bluetongue (OBT) ["catarrhal fever"] is administered with the use of live vaccine, the flaws of which include high reactogenicity and possible reversion of vaccine strains in carriers.

The efforts made by Currason (1942) to prepare a formol vaccine from the spleen and blood of sick sheep were not successful. Parker et al. (1975) reported on preparation of a culture vaccine inactivated with beta-propiolactone. However, experimental samples of such vaccine presented mild immunogenicity, since large doses (5-20 mℓ) were required to immunize sheep. Osbarn and Stoat (1979) reported on more successful attempts to obtain an inactivated culture vaccine.

Our objective was to develop a method of preparing inactivated vaccine against OBT. For this purpose, we investigated various conditions and technological procedures for manufacturing the product (maintenance of production strain of the virus, recovery, treatment and storage of raw viral material, conditions for inactivating the virus, choice of adjuvant, stabilization of inactivated product), and we developed methods for checking safety and immunogenicity of the vaccine; we also determined the indications for practical use thereof.

Use of optimum conditions enabled us to obtain, for the first time, a safe, highly immunogenic inactivated OBT vaccine. The method of preparing this product is protected by an author certificate (No 545145, dated 26 Nov 1975).

We devoted special attention to inactivation of the virus. We used three methods to check for complete inactivation: passages of inactivated product in a culture of PYa [expansion not known] cells; passages of blood from inoculated sheep to intact sheep, which were then examined for virus-neutralizing (VN) and complement fixing (CF) antibodies and immunity. All series of inactivated vaccines (more than 100 preparations) were found to be free of infectious virus.

Immunogenicity of the vaccine was tested on sheep by the method of control infection and titer of VN antibodies. Control infection was produced with a homologous virulent strain of OBT virus 21-30 days after vaccination. The reaction to the

vaccine, as well as to control infection of inoculated and noninoculated (control) sheep, was graded on a 30-point scale.

Immunogenicity of the vaccine was expressed as a grade for each animal and the average for a group. We determined the immunogenicity of the vaccine from the difference between reactions of noninoculated and inoculated sheep to control infection. The vaccine was considered immunogenic if the difference between reactions of control and inoculated sheep constituted at least 12 points. In some cases, a quantitative evaluation was made of immunogenicity of the vaccine, by calculating the 50% immunizing dose (Im D_{50}). For this purpose, the vaccine was administered once in doses of 0.5, 1 and 2 mℓ. Each dose was used on three sheep. The vaccine was deemed fit for vaccinating animals when Im D_{50} did not exceed 0.5 mℓ.

We determined the immunogenic properties of the vaccine as a function of dosage, frequency of administration and storage conditions. We tested 19 series of vaccine. In essence, the reaction to the vaccine constituted 2-3, and in only 2 cases 4 and 5.5 points, after single administration in a dosage of 2 mℓ. It must be noted that some sheep occasionally presented brief elevation of body temperature (to 41°), mild erythema of the mucous membranes of the eyes and nose, negligible mucous secretion from the nose and barely noticeable depression for the first 2-3 days after inoculation. An analogous reaction was observed after administration of virus-free constituents of the vaccine (placebo).

All of the tested series of inactivated vaccine were immunogenic in sheep. The reaction of inoculated animals to control infection with virulent OBT virus did not exceed a grade of 6-6.5, whereas in sheep that were not inoculated (control) it ranged from 18 to 30. In all cases, the efficacy of vaccination was graded at 14 to 29, and titer of virus-neutralizing antibodies ranged from 1:2 to 1:16.

It is known that the intensity of immunity from administration of an inactivated vaccine depends chiefly on the amount of viral antigen in the inoculation dose. For this reason, the quantitative method of evaluating its activity is of substantial importance.

We determined the immunizing dosage (Im D_{50}) by titration on sheep. The vaccine was administered once in doses of 2, 1 and 0.5 mℓ. All nine series we tested created stable immunity in the sheep. For all series, Im D_{50} was below 0.5 mℓ.

Vaccine stored at 2-6°C retained its immunogenic properties for 13-24 months (duration of observation period). Titration on sheep showed it to be highly immunogenic. Im D_{50} constituted 0.44 mℓ, versus <0.35 prior to storage. Liquid vaccine stored at room temperature (20-30°C) retained its immunogenic properties for 12 months (duration of observation period) and dry vaccine retained these properties for 6 months (duration of observation period). Two of the three samples of liquid vaccine stored at 37°C for 3-4 months were immunogenic; all three series of dry vaccine stored under the same conditions were not immunogenic.

Duration of immunity was determined on the basis of resistance of inoculated sheep to control infection, which was performed 3, 6, 9 and 12 months after vaccination, as well as according to presence of VN antibodies in blood serum of inoculated animals. The sheep were inoculated once in a dosage of 2 mℓ vaccine. The inactivated vaccine imparted marked immunity to sheep, which lasted at least

12 months (duration of observation period). The blood of these animals presented virus-neutralizing antibodies (mainly in dilutions of 1:8-1:16), which persisted at the same level throughout the observation period. No complement-fixing antibodies were found in these animals. The sheep acquired resistance to control infection 2 weeks after inoculation.

In addition, we tested the vaccine on lambs at the age of 2-2.5 and 4-5 months, in a dosage of 2 mℓ, given once or twice at a 15-day interval. Control infection with a virulent strain of the virus was performed 21-28 days after inoculation.

In 2-2.5-month lambs, single injection of inactivated vaccine did not elicit marked immunity. After control infection, all of them either perished or contracted the disease. Lambs inoculated twice were resistant to control infection. Lambs 4-5 months of age acquired marked immunity after a single inoculation.

These data indicate that the method we developed makes it possible to produce mildly reactogenic, safe and highly immunogenic vaccine against ovine bluetongue.

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AEROSOLS AGAINST AVIAN ECTOPARASITES

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[Article by V. D. Sokolov, S. R. Mamleyev, A. A. Tal'drik, Ye. D. Klevtsov, A. S. Shcherbakov, V. V. Shornikov, T. N. Nemilova, Ye. Ya. Sokolova, A. A. Lalayan, V. P. Nalbandyan, Yu. V. Kotlyar and V. P. Nazarov, All-Union Veterinary Scientific Research Institute of the Poultry Industry (VNIVIP)]

[Text] The methods used to treat buildings against ectoparasites with aqueous solutions, emulsions or suspensions of insecticides have some flaws (significant outlay of chemicals, corrosion of metal parts of equipment, relatively time-consuming work). For this reason, the aerosol method of extermination of insects and acarids merits attention. According to the data of a number of researchers (V. S. Yarnykh, R. V. Chirikashvili, I. Ya. Kholodov, Ye. Ya. Sokolova, B. A. Frolov, R. Sh. Kachekova, S. R. Mamleyev, M. P. Simetskiy), the aerosol method of using acaricidal and insecticidal agents is the most convenient and economical. It was established at the VNIVIP that product 4-74, from the group of carbamate compounds, has high specific activity, and an aerosol method of using it was developed. Neocidol ["neotsidol"] was taken as the standard of insecticidal activity. Studies were made of the effects of aerosols of both agents on fowl.

Material and Methods

At first, the acaricidal and insecticidal properties of 73% concentrate of agent 4-74 emulsion and 60% concentrate of emulsion of neocidol were evaluated under laboratory conditions by the wet method, by means of forced contact of bedbugs (Cimex lectularius) and fowl ticks (Argas persicum) with test objects treated with aqueous emulsions of the above preparations in concentrations of 0.001, 0.008, 0.05, 0.25, 1, 3 and 6%.

In developing under laboratory conditions the aerosol method of using agent 4-74, we used 0.1% aqueous emulsion of the agent for experiments with bedbugs and 2% emulsion for those with fowl ticks, which corresponded to LC_{100} [lethal concentration] in the experiment conducted by the wet method. As the control standard, we used 1 and 2% aqueous emulsions of neocidol. Aerosols were prepared with an Electrosol-1 generator and PVAN aerosol attachment, which yielded particles of 6-15 μm at a working pressure of 2.5-5 atm. The aerosols were tested under static conditions in a sealed aerosol chamber in the shape of a cube, 1 m^3 in size. The insects and ticks were placed on test objects (corrugated filter paper) in different spatial positions in the chamber before spraying the agent.

The aerosols of aqueous emulsions of the agents were sprayed on test objects situated in the plane. The treated surface, in the form of a circle, was 0.5 m^2 in size. We used the aqueous emulsions in doses of 10 to 50 $m\ell/m^3$. The diameter of the spray constituted 15-20 cm at a distance of 25 cm from the nozzle of the sprayer.

We determined the optimum acaricidal and insecticidal effects of the aerosols on the basis of death of ectoparasites as a function of treatment mode (outlay of agent per unit time, duration of exposure). We selected the concentrations of the agents on the basis of identical acaricidal and insecticidal properties.

We tested acute and subacute toxicity of agent 4-74 and neocidol on chickens, guinea pigs and golden hamsters. The agents were given by mouth once, in the form of 10% aqueous emulsion, in doses of 100 to 750 mg/kg (of active substances).

We tested the cumulative properties of agent 4-74 and neocidol in acute experiments on chickens, guinea pigs and golden hamsters by giving them the agents daily in a dosage of 1/10 LD_{50} according to active substance, daily. The experiments lasted 60 days.

Acute and subacute experiments were conducted on 64 (Khayseks) chickens at the age of 6 months weighing 1.80-1.97 kg. In the acute experiments, the chickens were treated with 2% aerosols of the agents in doses of 10, 15, 20 and 25 $m\ell/m^3$, with exposure for 30-45 min.

The subacute experiments lasted 21 days. The experimental group of chickens was treated twice a week, at 1-day intervals, with 2% aqueous emulsion in aerosol form of agent 4-74 or neocidol in a dosage of 15 $m\ell/m^3$.

Clinical signs and the state of the adrenocorticohypophyseal system, body weight and weight of viscera, egg laying, protein and protein fraction content, cholinesterase activity and alkaline balance in blood served as indicators of the toxic effects of these products.

Cholinesterase activity was assayed by the method of Khestrin as modified by the Kiev Scientific Research Institute of Industrial Hygiene and Occupational Diseases (1960) 24, 48 and 72 h after acute inhalation by the fowl; in the case of chronic inhalation, it was assayed monthly during the period of exposure. Alkaline phosphatase was analyzed at the same times by the paranitrophenyl phosphatase method.

We made a quantitative assay of total protein and fractions thereof in blood serum of chickens by the method of I. V. Slutskiy (1964) before exposure, during and after it.

We took pieces of internal organs and tissues for histological and histochemical analysis from experimental chickens that died under the influence of aerosols of agent 4-74 and neocidol. This material was fixed in 5% neutral formalin, Carnoy fluid and 96% ethyl alcohol. Frozen and paraffin sections were stained with hematoxylin-eosin, according to Van Gieson and Slinchenko (for connective tissue), Feulgen and Brachet (for RNA), Sudan black (for lipids), Kiseli (for ketosteroids) and by the method of Bargmann (for demonstration of alpha and beta cells of the hypothalamic and neurosecretory substance).

Results

It was established that LC_{50} of agent 4-74 constituted 0.53% for bedbugs and 1.80% for the Persian ticks. The ticks died when treated with 0.05% aqueous emulsion of neocidol and bedbugs died with 0.001% or higher concentration.

The optimum mode of operating the aerosol under static conditions, based on outlay of product and insecticidal effect, was found to be 30 min of spraying and 1 h of subsequent exposure of the test object in the aerosol atmosphere. Outlay of product constituted 10-15 $m\ell/m^3$. With aimed spraying, the optimum outlay of insecticidal liquid constituted 30 $m\ell/m^2$ treated surface in the experiment. Guided aerosols had more effective insecticidal properties than a static aerosol environment.

The parameters of toxicity of the insecticides for chickens were determined in acute experiments. LD_{50} for agent 4-74 constituted 275 mg/kg, LD_{100} was 425 mg/kg, threshold dosage of 125 mg/kg and range of toxic effect was 1/1.2; for neocidol the figures were 19.5 mg/kg, 51, 7.3 mg/kg and 1/2.62, respectively.

Subacute experiments on chickens revealed that agent 4-74 and neocidol do not have marked cumulative properties, the coefficients of accumulation being 2.5 and 4.6. There were no clinical signs of intoxication or deaths of chickens due to toxicosis. Prolonged exposure to these agents did not affect body weight or egg-laying.

Single and repeated treatmert of chickens with aerosols of agent 4-74 and neocidol did not lead to death due to toxicosis, had no effect on weight of body or viscera, or on egg-laying capacity. The acaricides and insecticides used in aerosol form did not have cumulative properties.

The blood serum of chickens submitted to agent 4-74 or neocidol in aerosol form failed to demonstrate noticeable changes in composition of protein and protein factors, or depression of cholinesterase. Alkaline phosphatase level in blood serum was in the physiological range, and this was also confirmed histochemically.

Postmortems done on fowl treated with agent 4-74 failed to demonstrate macroscopically marked changes.

Histological studies revealed hyperemia and considerable epithelial swelling in the larynx, with hyperplasia of epithelium, diffuse and focal infiltrates of lymphoid and histiocytic cells. There was proliferation of lymphoid and histiocytic cells in the trachea. The lungs were hyperemic or edematous in some places, some areas were infiltrated with lymphoid and histiocytic cells around the blood vessels, bronchi and parabronchi. The endothelium of blood vessels was swollen. In some places, the myocardium was infiltrated with isolated lymphoid and histiocytic cells; its fibers were somewhat swollen.

In the liver there were perivascular proliferates of lymphoid and histiocytic cells with an admixture of pseudoeosinophils. In the kidneys, there was insignificant swelling and hyperemia of the glomerules, and some lymphoid cells. The epithelium of the straight and convoluted tubules was swollen, their nuclei varied in size and hyperchromism. The spleen was plethoric; the follicles of white pulp were hyperplastic.

In red pulp there was a large amount of hemosiderin pigment and cells loaded with this pigment. The branched arteries were well-defined.

In the adrenals, there was a decrease in lipid content, hyperchromism of cells and poor staining of nuclei for DNA and RNA. The hypophysis was somewhat hyperemic; in some places the round cells had an uneven Nissl substance level. RNA stained intensively. There was more intensive staining for neutral mucopolysaccharides and acid phosphatase of the bodies and processes of neurons. There was intensive proliferation of parietal cells with noticeable methylophilia of their nuclei in the infundibulum of the pituitary.

After 10-15 days, these changes in organs reverted to normal.

Histological examination of chickens sacrificed after exposure to neocidol aerosols for 2 weeks also revealed a number of changes. The myocardium was infiltrated with lymphoid cells. The kidneys were hyperemic, their glomeruli were swollen and, in some areas, showed focal infiltration by lymphoid and histiocytic cells. Some focal accumulations of lymphoid and histiocytic cells were encountered in the liver (particularly near the bile ducts and blood vessels); there was also eosinophilic granulation and vacuolization of hepatocyte cytoplasm. The cuticle of the gizzard was thinned down, with erosions in some places. There were diffuse focal accumulations of lymphoid and histiocytic cells under the epithelium of the esophagus, gizzard and intestine.

The data obtained from laboratory studies of efficacy of aerosols of agent 4-74 and neocidol, as well as information about their toxicity, made it possible to continue investigation of the aerosol method of using these products under actual production conditions at the Echmiadzin Poultry Plant in Armenian SSR.

First, the parasitological situation had been thoroughly studied at the poultry farm. The poultry plant was found to have a problem with Persian ticks and bedbugs. In the rooms invaded by the ectoparasites there was an average of 500-1200 bedbugs per square meter and up to 50 ticks per square meter of walls.

Aerosols of aqueous emulsion of agent 4-74 and neocidol were used in accordance with the instructions for use of neocidol to control Ixodes ticks, Psoroptes infestation of sheep and ectoparasites of fowl.

The premises were treated against Argas ticks with aerosols of 2% aqueous emulsions of the agents, and aerosols of 1% aqueous emulsion were used against bedbugs. The premises were treated with 6% chlorophos solution, used at the rate of 200 $m\ell/m^2$, to check the acaricidal and insecticidal efficacy of agent 4-74 and neocidol.

Neocidol aerosol was used to treat two rooms and aerosols of agent 4-74 for three buildings with stock hens and commercial poultry. Chlorophos (control) was used in two coops invaded by bedbugs and Argas ticks. In all, 15,000 m^2 coop surfaces with a capacity for over 60,000 fowl, were treated. Two premises with a problem with the ticks and bedbugs were left untreated temporarily as an "infected control."

The premises were treated in two stages: preliminary treatment after emptying the coops (before mechanical cleaning of the premises) and main treatment, after disinfecting the premises, 3 days before putting fowl back. The chickens could be butchered 12 days after being placed in coops treated with insecticides.

Argas ticks perished within 5-30 days and bedbugs within 3-5 days after treatment of premises with agent 4-74 or neocidol aerosols. A 6% solution of chlorophos was found to be ineffective against these ectoparasites. According to the preliminary

observations, residual acaricidal and insecticidal properties of agent 4-74 and neocidol persisted for more than 1.5 months.

The annual economic effect from using agent 4-74, as compared to chlorophos, constituted 940 rubles, and the effect from using neocidol was 760 rubles.

Thus, the aerosol method of using acaricides and insecticides in poultry farming was found to be effective and economically advantageous in our experiments.

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MYCOTOXICOSES OF AGRICULTURAL ANIMALS

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[Abstract] Pertinent data reported during the period 1965-1978 has been analyzed. The following mycotoxicoses were registered in the Ukrainian Republic: stachibotriotoxicosis, aspergillotoxicosis and fusariotoxicosis. These diseases were most common in the steppe and the forest-steppe regions from December to March. Stachibotriotoxicosis predominantly attacked cattle (57.7%), followed by horses (29.5%) and small horned animals (16.4%). Pigs suffered mostly from fusariotoxicosis (88%) and aspergillotoxicosis (58.1%). Prophylactic measures against stachibotriotoxicosis should concentrate on storing forage under conditions which prevent propagation and dissemination of toxic fungi. No easy preventive measures exist against the other two diseases. That problem should be studied intensively. References: 5 Russian.
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